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TRANSACTIONS

OF THE

SOCIETY

FOR THE ENCOURAGEMENT OF

ARTS, MANUFACTURES, AND COMMERCE.

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TRANSACTIONS

OF THE

Royal **SOCIETY**, of Arts

Instituted at London,

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURES, AND COMMERCE;

WITH THE

PREMIUMS OFFERED IN THE YEAR 1821.

VOL. XXXIX.

LONDON:

SOLD BY THE HOUSEKEEPER, AT THE SOCIETY'S HOUSE IN THE ADELPHI;

AND BY ALL BOOKSELLERS.

[*Price Ten Shillings and Sixpence.*]

MDCCCXXI.

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ARRANGEMENT

OF THE VOLUME.

PREFACE.

PREMIUMS, offered in 1821.
LIST OF OFFICERS.
GENERAL CONDITIONS.
REWARDS BESTOWED.

Papers in Agriculture - - - - - - - - - - - - 1
Papers in Polite Arts - - - - - - - - - - - - 43
Papers in Manufactures - - - - - - - - - - - 52
Papers in Mineralogy - - - - - - - - - - - - 55
Papers in Mechanics - - - - - - - - - - - - 70
Papers in Colonies and Trade - - - - - - - - - 155

Presents received - - - - - - - - - - - - 177
Models and Machines of the present Year - - - - 185

LIST OF MEMBERS.
INDEX.

Digitized by Google

LIST OF PLATES,

AND DIRECTIONS FOR PLACING THEM.

		to face p.
1.	Mr. Palmer's Ploughs Mr. Rotch's Arcograph	12
2.	Mr. Barlow's Apparatus for Correcting the Mariner's Compass	79
3.	Mr. Rider's Machine for Cutting Tips for Hats Mr. Story's Portable Oven	71
4.	Mr. Baker's Bullet Mould Lieut. Nicolas's Semaphore Mr. Brandt's Pendulum-crutch	103
5.	Mr. Goodwin's Spring-cross for Horses	112
6.	Mr. Witty's Fire-Escape	130
7.	Mr. Perkins's Stove Mr. Lake's Door-hinge	134
8.	Mr. Perkins's Instruments for ascertaining the Trim of a Ship	128
9.	Mr. Earle's Bed for Patients under Surgical Treatment	123
10. 11.	Mr. Allan's Machine for Dividing Circular Arcs and for Cutting the Divisions	146

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PREFACE.

THE Committee of Correspondence and Papers, to whom, with the Secretary, the publication of the annual Volume of Transactions is intrusted, have, for the last three or four years, been strenuously exerting themselves to expedite, as far as possible, this very important object. For this purpose they have continued their weekly meetings through the greater part of the vacation, devoting their time and attention to the multifarious details which the due execution of the business confided to them by the Society urgently requires. The success which has attended their labours in this respect, has been eminently gratifying to them. Never before has so short a period intervened between the conclusion of a Session, and the publication of its Transactions. The ground thus gained will, it is hoped, be permanently secured, and the present success serve as a stimulus and example for the future.

On a review of the contents of the present Volume, it will be found that the Communications rewarded during the late Session, fully keep up the

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credit of the Society as the depository of useful inventions, and the encourager of undertakings which combine private advantage with the public good. The Communications of C. F. Palmer, Esq. M. P., of Sir W. Templer Pole, Bart., of Mr. Wilkinson, and of Mr. Potts, on planting Forest Trees, and raising Oaks; of Mr. Dawson, on Embanking Land from the Sea, and of J. C. Curwen, Esq., M. P. on Draining, are very satisfactory, as showing, that the severe privations to which the proprietors of land have of late years been subject, from the diminished demand for agricultural produce, has by no means extinguished in them that liberal sacrifice of present emolument to great prospective advantages, by which their permanent interest is best secured.

In the class of Polite Arts, Mr. Steart's Drawing Paper for the use of Artists has been thought worthy of the Society's reward, both on account of the excellent quality of the material of which it is formed, and on its freedom from those defects to which thick papers composed of several layers are unavoidably subject.

The praiseworthy and successful endeavours of Mr. Salisbury to open a new source of industry, peculiarly within the reach of the labouring poor, and of parochial workhouses, have received the ap-

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probation of the Society, both on their own account, and in the hope, that by being recorded in the Volume, they may excite others to similar exertions. A material hitherto unemployed, the spontaneous produce of pools and irreclaimable swamps in every part of the kingdom, peculiarly fitted to serve as the basis of domestic manufacture in the cottages of the poor, and the produce of which, whether sold or employed by the makers, will contribute essentially to the increase of their comforts, is not to be lightly passed over. One of the most serious privations to which cottagers in the agricultural districts are exposed, is that of cold during Winter, arising in part from the inadequate shelter afforded by the hovels in which they live, and from the want of bedding. Their own pecuniary resources are but too often insufficient to supply the more imperious demands for food and clothing; so that in ordinary circumstances their sufferings from cold during the hours intended by nature for repose and restoration, are excessively severe, as those well know who have seen, with satisfaction not unmingled with sorrow, the joy which the donation of a single blanket invariably produces. If those who have the opportunity, would instruct and encourage the industrious poor in the manufacture of matting from the "Typha," they would thus be enabled to supply themselves with an article, which, when employed as a cover to their damp floors, as curtains to their couches, and as an auxiliary to their

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scanty stock of bedding, would most materially contribute both to their comfort and to their health.

The discovery of a Quarry of Millstone in Halkin Mountain, near Holywell, has deservedly entitled Mr. Bishop to a small Gold Medal. Hitherto no millstones for grinding wheat at all comparable to the French Buhr had been discovered in Great Britain; and in time of war serious inconvenience had been felt from the scanty and uncertain supply of so essential an article. Mr. Bishop and his partners have had the good fortune to discover, and the perseverance to bring into fair trial, a stone which, judging from the specimens laid before the Society, and from very satisfactory testimonials from all the millers who have made use of it, bids fair, in a great degree, if not entirely, to supersede the necessity of having recourse to a foreign and too often hostile country for the means of preparing our daily bread.

In the class of Mechanics the most important communication is Mr. Barlow's, of his improved apparatus for the purpose of correcting the Aberration of the Mariner's Compass, occasioned by the local attraction of the iron on board a ship. This aberration, amounting in many cases to several degrees, and varying according to the position of the ship's head with respect to the magnetic poles, has been a continual, and (till the observations of

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the late Captain Flinders) an unsuspected cause of error in ships reckonings. It was reserved for Mr. Barlow, by a series of most ingenious and satisfactory experiments, to discover the laws of this variation, and then to reduce his philosophical investigations to practical utility, by the invention of an apparatus of extreme simplicity, by which all mistakes in navigation arising from this source are completely avoided. The intrinsic merit of the discovery, and its peculiar value to a country ranking first among the maritime powers, have induced the Society to confer unusual marks of their approbation on Mr. Barlow.

The large Gold Medal has been bestowed on Mr. Perkins, for his very ingenious and useful application of the Mercurial Level to the use of the navigator in ascertaining the Trim of a Ship, or that degree of inclination with regard to the horizon, which is requisite for the most rapid passage through the water. By means of this instrument, the navigator is enabled to adjust the angular inclination of his ship with a degree of precision wholly unknown before, and thus to make the utmost possible advantage of the wind.

In a former Volume the Society have published the description of Mr. James Allan's machine for dividing the Circular Limbs of Mathematical and Astronomical Instruments. The liberal reward

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bestowed subsequently on the inventor by the Board of Longitude, for the unrivalled accuracy of his Engine, coinciding with the previously expressed opinion of the Society, has induced them to bestow a farther reward on the inventor, for his apparatus for cutting the Divisions. The description of this apparatus, added to that of the Dividing Circle itself in Vol. 28, completes the account of this admirable machine; and the Society regret, that the recent and untimely death of this excellent artist has deprived them of an associate whose abilities and public spirit have repeatedly entitled him to their honorary medals.

The large Gold Medal, being the highest mark of the Society's approbation, has been bestowed during the last session on Henry Earle, Esq. for his Bed for Patients under Surgical Treatment, by which the temporary ease and final cure of persons suffering under the most serious accidents and constitutional derangements of the bony structure of the body, are very materially advanced.

Mr. Brandt's Spring Pendulum Crutch, by which a clock is put into beat with greater precision, and in shorter time than by the common method of bending the crutch by hand, has received a Medal, and no doubt will be found useful on many occasions. Mr. Rotch's Arcograph, Mr. Rider's machine for cutting Tips for Hats, Mr. Baker's

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Bullet Mould, Mr. Reveley's substitution of Soap for Oil in setting Cutting Instruments, Mr. Goodwin's Spring Cross for Horses, Mr. Story's Portable Oven, and Mr. Lake's Double Door-hinge, fulfil respectively the purposes for which they were intended, and will be duly appreciated by those who may stand in need of them.

The reward bestowed on Mr. Witty for his Fire-Escape, is in accordance with the desire which the Society have always felt to encourage to the utmost those inventions which offer even a rational probability of use under circumstances the most appalling to human nature.

The attention which Dr. Wallich, Superintendent of the Botanic Garden at Calcutta, has shown to the interests of the Society of Arts, by an active correspondence with the Secretary and by the frequent transmission of seeds and other articles, demands this public acknowledgment of respect. A selection from the letters of this gentleman, containing several interesting particulars respecting the Mountain Rice of Napal, is inserted in the present Volume.

Such are the contents of the Volume now offered to the acceptance of the public; and if from the perusal of the following pages any benefit should accrue to individuals, to the country, or to society

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at large, the object of this Institution will be fully attained.

THE Society take the present opportunity of returning their Thanks to the different Public Bodies and Individuals who have honoured them with Presents during the Session, the particulars of which are noticed in the body of the Volume. Without presuming to direct in what channels the liberality of the friends to this Institution shall flow, it may be stated that such contributions as may put the Society in possession of a complete collection of the Publications of any value on the application of Mathematics to practical Mechanics, will be especially acceptable.

The Society also acknowledge the receipt of the greater part of a Legacy of 500*l.*, bequeathed to them by the late Dr. Anthony Fothergill. The legal forms, necessary to substantiate their claim and to put them in possession, have been gone through, and rendered effective by W. Tooke, Esq., Vice-president, to whose gratuitous professional assistance the Society have on various occasions been indebted.

The Society desire it to be clearly understood that, as a Body, they are not responsible for any Opinion or Representation of Facts, contained in the following Pages.

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ERRATA.

IN VOLUME XXXVII.

In List of Plates 13, *for* "Mr. Smith's Bow and Spring," *read* Mr. Smart's Bow and String.

Page 18, *line* 16, *for* "Fig. 1," *read* Fig. 4.

—— 67, — 6, *for* "Model," *read* Drawing.

—— 73, — 3 *and* 4 *from bottom, dele* "each succeeding one filling up the interstices of the former."

—— 73, — 23, *for* "The first and second strings (figs. 6, 7), should be a violoncello third and fourth of the largest size," *read* The first string fig. 7, should be a violoncello fourth of the largest size *i*, covered by a smaller one *k*. The second string, fig. 6, should be a violoncello third *g*, covered by a smaller one *h*.

—— 74, — 12, *for* "C and G," *read* G and C.

—— 114, — 18, *for* "corner," *read* corners.

—— 204, — 15 *and* 17, *dele* "The late".

IN VOLUME XXXVIII.

Page 29, *line* 6, *for* "figure 4," *read* figure 1.

—— 30, — 8, *from bottom, for* "drawn," *read* withdrawn.

—— 79, — 13, *after* "fig. 5," *add, a* the body of the anvil; *b* the quarter; *c* the beak; *d d d* the feet.

—— — — 6 *from bottom, after* "iron," *add, a* fig. 6, *after* "another," "*add b, and omit in the following line,* "as shown fig. 6."

—— 81, — 2, and 3, *for* "the radiant heat from the stove is rapidly carried off," *read* the heat is rapidly carried off from the stove.

—— 81, — 8 *from bottom, for* "diameter," *read* circumference.

—— 91, — 10, *for* "outline plan," *read* elevation in outline.

—— 91, — 12, *for* ditto *read* ditto.

—— 91, — — *insert line* 14 *between lines* 11 *and* 12.

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ERRATA.

Page 99, *line* 14, *for* " transverse," *read* traverse.
——104, — 10, *for* " the 1st, 3rd, or 4th portions," *read* the 1st, 2nd, 3rd, or 4th junctions of the hose.
——104, — 15, *for* " female," *read* male; *and for* " which is attached to the hose," *read* to which the hose is attached.
——104, — 16, *for* " it is," *read* the hose is.
——104, — 6 *from bottom, for* " B," *read* h.
——105, — 5 *from bottom, for* " they," *read* that.
——110, — 5, *for* " from," *read* through.
——112, — 15, *for* " they," *read* the tumblers.
——120, — 7 *from bottom, for* " pole," *read* pall.
——122, — 2 *from bottom, for* " fig. 3 a horizontal view," *read* figs. 3 and 4 are elevations.
——124, — 8 *from bottom, for* " z," *read* 2.
——125, — 11 *from bottom, for* " adapted," *read* adopted.
——126, — 2 *from bottom, for* " ruder," *read* rudder.
——142, — 4, *for* " the extremity of the floats of each paddle wheel is connected," *read* the extremities are connected.
——146, — 5, *for* " board *h ; i*," *read* board; *h i*.
——146, — 14, *for* " *p q*," *read* *p p*.
——163, — 7 *from bottom, for* " requires," *read* acquires.
——172, — 10 *from bottom, for* " *c*," *read* C.
——174, — The *o* on the escape wheel, is by mistake made O in the engraving.
——176, — 3 *from bottom, for* " preceding," *read* succeeding.
——177, — 22, *for* " lower," *read* upper.
——177, — *last line, for* " tooth next succeeding the tooth 17," *read* the tooth 17.
——178, — 1, *for* " before," *read* behind.
——180, — 8 *from bottom, for* xxxvii, *read* xxxviii.
——182, — 14 *from bottom, for* " 38," *read* 37.
——184, — 16, *for* " xxxviii," *read* xxxvii.

IN THE LIST OF PREMIUMS FOR 1821-1822,
Page xxiv, *last line but one, for* " No. 163," *read* No. 153.

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Premiums offered

IN THE SESSION 1821—1822.

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A LIST of the OFFICERS of the SOCIETY.

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ADVERTISEMENT TO THE PUBLIC.

THE chief object of the SOCIETY is, to promote the Arts, Manufactures, and Commerce of this Kingdom, by giving honorary or pecuniary Rewards, as may be best adapted to the case, for the communication to the SOCIETY, and through the SOCIETY to the Public, of all such useful Inventions, Discoveries, and Improvements (whether specified in these Premiums or not) as tend to that purpose; in pursuance of this plan, the SOCIETY have already expended upwards of EIGHTY-FIVE THOUSAND POUNDS, derived from voluntary subscriptions and legacies.

The meetings of the SOCIETY are held every Wednesday, at seven o'clock in the evening, from the first Wednesday in November to the second Wednesday in June. The Committees meet on other evenings in the week during the session, for the purpose of taking into consideration the subjects referred to them by the SOCIETY. A person desirous of becoming a Member of the SOCIETY, may be proposed according to the following form, which must be signed by three Members of the SOCIETY, and delivered in to the Secretary:

A. B. [*Trade, Profession or Designation of the Candidate*] proposed as a Member of the Society for the Encouragement of Arts, Manufactures, and Commerce by

C. D.
[*Date*] E. F.
G. H.

Peers of the Realm, or Lords of Parliament are, on their being proposed, immediately balloted for; the names of other persons proposed to become Members are read by the Secretary to the SOCIETY, and are then inserted in lists which are hung up in the SOCIETY's room; they are balloted for at the second following ordinary meeting. In both cases, if two-thirds of the Members then voting ballot in their favour, they are deemed Perpetual Members upon payment of not less than Twenty Guineas in one sum, or Subscribing Members upon payment of any sum not less than Two Guineas annually.

Ladies are eligible as Members of the SOCIETY, and alone are entitled to vote by proxy at elections, through the medium of any gentleman who is a Member, on his producing a written authority for the same.

Members are entitled to vote and assist in all the business of the SOCIETY and of the several Committees. They have also the privilege of recommending two persons as visitors at the meetings of the SOCIETY; and, by addressing a note to the housekeeper, of introducing their friends on any week day, except Wednesday, between the hours of ten and two, to examine the various Models, Machines, and Productions, in different branches of Arts, Manufactures and Commerce, for which rewards have been bestowed; also to inspect the magnificent series of Moral and Historical Paintings, executed by the late J. BARRY, Esq. which, with some valuable Busts, Statues, Portraits, &c. decorate the public rooms of the SOCIETY.

Members have the use of the SOCIETY's Library, which is valuable, and annually increasing by the purchase and donation of scientific and useful books, and of engravings. Contributions from Members and others, in augmentation of the Library and of the collection of Maps and Prints, will be thankfully received, and duly acknowledged in the annual volume of the Society's Transactions, to a copy of which every Member is entitled.

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*** To persons inclined to leave a sum of money to this SOCIETY by Will, the following form is offered for that purpose:

Item.—I give and bequeath to A. B. and C. D. the sum of upon condition and to the intent that they, or one of them, do pay the same to the Collector for the time being, of a Society in London, who now call themselves the Society for the Encouragement of Arts, Manufactures, and Commerce; which said sum of I will and desire may be paid out of my personal estate, and applied towards the carrying on the laudable designs of the Society.

The SOCIETY desire it to be clearly understood, that as a Body they are not responsible for any opinion or representation of facts contained in their Volumes. And the Public are requested to guard against impositions, from persons advertising as having Patents for Articles rewarded by the SOCIETY; they are also cautioned against purchasing articles sold under the pretended sanction of the SOCIETY's name.

The SOCIETY have lately published the 38th *Volume* of their Transactions, which may be had by Members on application to the Housekeeper. Complete SETS of their TRANSACTIONS, or any single Volume, may be purchased at the SOCIETY's house: where may be had also,

An *Analytical Index of the first Twenty-five Volumes* of the Transactions to the Termination of the Session, June 1807, price 2*s.* 6*d.*

A list of the Machines and Models in the SOCIETY's Repository, to the year 1813, inclusive.

A Catalogue of Books in the SOCIETY's Library, 1*s.*

A description of Mr. Barry's Paintings in the Great Room of the SOCIETY.

All communications are to be made by letter, addressed to ARTHUR AIKIN, Esq. the Secretary, at the SOCIETY OF ARTS, &c. Adelphi, London.

And where articles are sent by Sea for the SOCIETY, the Bills of Lading are to be addressed to the care of WILLIAM VAUGHAN, Esq., Mincing-lane, London, who has undertaken to receive them for the SOCIETY,

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GENERAL NOTICE TO CANDIDATES.

THE great object of the Society in rewarding individuals is, to draw forth and give currency to those inventions and improvements which are likely to benefit the public at large. Candidates are therefore requested to observe, that if the means by which the respective objects are effected, require an expense or trouble too great for general purposes, the Society will not consider themselves bound to give the offered reward; but, though they expressly reserve the power, in all cases, of giving such part only of any premium as the performance shall be adjudged to deserve, or of withholding the whole if there be no merit, yet the Candidates may be assured the Society will always judge liberally of their several claims.

The Society by no means restrict their liberality to the subjects for which premiums are specially offered, but will take into consideration, and will reward, by a bounty proportioned to its merit, any communication, the subject of which is of a practical nature, and calculated to promote the public good.

All communications are to be made by letter addressed to the Secretary, and are to contain full and particular details, according to the nature of the subject, as well as accurate descriptions of such Drawings and Models as form part of the communication: the Models to be sent carriage paid.

In those cases in which certificates are required to be produced in claim of premiums, they should be expressed, as nearly as possible, in the words of the conditions attached to the respective premiums, and be signed by disinterested persons, who have a positive knowledge of the facts stated.

The premiums are designed for the United Kingdom, unless expressly mentioned to the contrary; but no claim will be attended to, unless the previous conditions have been fully complied with.

No person shall receive any premium, bounty, or encouragement, from the Society, for any matter for which he has obtained any premium or reward from any other Society, or for which he has obtained, or purposes to obtain a patent; it being a condition stipulated with every candidate, that all articles rewarded by the Society, shall be freely given up to the public, to be made or manufactured by any person whatever.

All Models, the production of which is attached as a condition to any premium, shall, upon the delivery of such premium, remain the property of the Society.

Where premiums or bounties are obtained in consequence of specimens produced, the Society will retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No member of this Society shall be a Candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medal of the Society.

No Candidate, not a member, shall be present at any meeting of the Society or Committees, or admitted at the Society's rooms, after they have delivered in their claims, until such claims are adjudged, unless summoned by the Committee.

A Candidate for a premium, or a person applying for a bounty, being detected in any attempt to impose on the Society, shall forfeit such premium or bounty, and be deemed incapable of obtaining any for the future.

The consideration of the Claims for the premiums offered in the present List, will take place during the Session of the Society commencing on Wednesday, the 5th of November, 1821. The several Candidates and Claimants, to whom the Society shall adjudge Premiums or Bounties, are to attend on the last Wednesday in May, at eleven o'clock in the forenoon precisely, to receive the same, that day being appointed by the Society for the Distribution of their Rewards; and before that time no Premium or Bounty will be delivered, except to those who are about to leave the Kingdom.

In cases where the Society may think fit to admit excuses for not attending in person, Deputies may be substituted to receive the rewards, provided such Deputies are either Members of the Society, or superior Officers thereof.

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PREMIUMS IN AGRICULTURE.

N. B.—The Winchester bushel is the measure referred to for grain; and, as the Acres of different districts vary in extent, it is necessary to observe, that the Society mean Statute acres of five and a half-yards to the rod or pole, and they request that all communications to them may be made agreeably thereto.

1. Improvement of Land.

Gaining Land from the Sea.

1. TO the person who shall have gained the greatest quantity of Land from the Sea, not less than fifty acres, on the coast of Great Britain or Ireland; —*the Gold Medal.*

Certificates of the quantity of Land, and that the experiments were begun after the first of January, 1816, to be produced to the Society on or before the first Tuesday in February, 1822.

2. The same premium is extended one year farther, on the same conditions.

Improving Waste Land.

3. For the most satisfactory account of the best method of improving any one of the following soils, being Land lying Waste and uncultivated, viz. clay, gravel, sand, chalk, peat earth or bog, verified by experiments on not less than fifty acres of land;—*the Gold Medal.*

4. For the next greatest quantity, not less than thirty acres;—*the Silver Medal.*

It is required, that the Land, before such improvement, be absolutely uncultivated, and in a great measure useless, and that in its improved state, it be inclosed and cultivated.

Certificates of the number of acres, of the quality of the Land so improved, with a full account of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof, to be produced on or before the first Tuesday in February, 1822.

Manures.

5. For the most satisfactory set of experiments, to ascertain the comparative advantages of the following Manures, used as top-dressings on grass and corn land, viz. soot, coal-ashes, wood-ashes, lime, gypsum, bones, night-soil, or any other fit article;—*the Gold Medal.*

It is required that the above experiments be made between two or more of the above-mentioned Manures, and that not less than two acres of land be dressed with each Manure.

An account of the nature of the soil, quantity, and expense of the manure and crops, with certificates, to be produced on or before the last Tuesday in February, 1822.

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2. Plantations.

Forest Trees.

6. To the person who shall have inclosed and planted, or set, the greatest number of acres (not less than fifteen) of land that is incapable of being ploughed, such as the borders of rivers, the sides of precipices, and any land that has too many rocks, or that is not calculated to repay the expense of tillage, owing to the surface being too hilly, mountainous, or otherwise unfit for tillage, with the best sorts of Forest Trees, namely, oak, Spanish chesnut, ash, elm, beech, alder, willow, larch, spruce, or silver fir (with or without screens of Scotch fir) adapted to the soil, and intended for timber trees, between the first of Oct. 1818, and the first of April 1819;—*the Gold Medal.*

7. For the second greatest quantity of land; not less than ten acres;—*the Silver Medal.*

A particular account of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper certificates that they were in a healthy and thriving state two years at least after

making the plantations, to be delivered to the Society on or before the second Tuesday in February, 1822.

N. B. With the above Forest Trees, the seeds, cuttings, or plants, of such other trees as are adapted to the soil, and proper for underwood, may or may not be intermixed.

Oaks.

8. To the person who shall have raised, since the year 1817, the greatest number of Oaks, not fewer than five thousand, either from young plants or acorns, in order to secure a succession of oak timber in this kingdom;—*the Gold Medal.*

9. For the next greatest number, not fewer than three thousand;—*the Silver Medal.*

Certificates that there were on the land at least the number of young Oak Trees required, in a thriving condition, two years after the planting, with an account of the methods pursued in making and managing the plantation, to be produced to the Society on or before the first Tuesday in February, 1822.

Oaks, not transplanted.

10. For having set, between the first of October, 1819, and the first of April, 1820, the greatest quantity of land, not less than ten acres, with Acorns, with or without seeds, cuttings, or plants of other trees, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

11. For the second greatest quantity of land, not less than five acres, set agreeably to the above conditions;—*the Silver Medal.*

Certificates of setting agreeably to the above conditions, and that there are not fewer than three hundred young Oaks on each acre, to be delivered to the Society on or before the first Tuesday in February, 1822.

Elm.

12. For having planted the greatest number of the English Elm, not less than eight thousand, between the 24th of June, 1819, and the 24th of June, 1820, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

13. For the second greatest number, not less than five thousand;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, that the plants were in a healthy and thriving state two years at least after making the plantation, and specifying the distance of the plants, to be delivered to the Society on or before the first Tuesday in April, 1822.

Larch.

14. For having planted out, between the 24th of June, 1818, and the 24th of June, 1819, the greatest number of Larch Trees, not fewer than five thousand, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

15. For the next greatest number, not fewer than three thousand;—*the Silver Medal.*

Certificates of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in February, 1822.

N. B. The Larch Trees may be planted either mixed with other trees, or by themselves, as may best suit the convenience of the planter.

Ash.

16. For having sown or set, in the year 1818, the greatest quantity of land, not less than six acres, with Ash for timber, with or without seeds, cuttings, or plants of such other trees as are adapted to the soil;—*the Gold Medal.*

17. For the next greatest quantity, not less than four acres;—*the Silver Medal.*

Certificates of the sowing or setting, agreeably to the above conditions, and that there are not fewer than six hundred Ash Plants on each acre, in a thriving and healthy condition, two years at least after the sowing or setting, with a general account of the methods used in making the planta-

tion, to be delivered to the Society on or before the last Tuesday in February, 1822.

Norway Fir.

18. To the person who shall have planted in the united kingdom, during the year 1819, the greatest number, not less than two thousand, of red wood and white wood Norway Fir Seedlings, at sufficient distances from each other to stand for timber trees;—*the Gold Medal.*

Certificates of the number of plants, that they were in a thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the first Tuesday in February, 1822.

N. B. It is recommended to plant the seedlings of about three or four years growth, and in a moderately good soil, somewhat sheltered; the wood from the district of Christiana is esteemed the best for carpenters' and joiners' use: and for spars and ufers the trees near to Long Sound are most valued.

Chesnuts.

19. For having sown or set between the first of October, 1819, and the first of April, 1820, the greatest quantity of land, not less than six acres, with Spanish Chesnuts, with or without seeds, cuttings, or plants of other trees, adapted to such soil, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

20. For the second greatest quantity, not less than four acres;—*the Silver Medal.*

Certificates of sowing or setting, agreeably to the above conditions, and that there are not fewer than three hundred Chesnut Plants in a thriving state, on each acre, to be delivered to the Society on or before the first Tuesday in February, 1822.

Walnut Trees.

21. For having planted the greatest number of Walnut Trees, not less than five hundred, since June, 1819, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

22. For the next greatest number, not fewer than three hundred;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, and that the plants were in a healthy and thriving state two years at least after making the plantation, and specifying the distance of the plants from each other, to be delivered to the Society on or before the first Tuesday in April, 1822.

Securing Plantations.

23. To the person who shall give to the Society the most satisfactory account, founded on experience, of the most effectual and least expensive method of securing young plantations of timber trees and hedge rows, from hares and rabbits, as well as from sheep and cattle, which at the same time shall be least subject to the depredations of wood-stealers;—*the Silver Medal.*

The accounts, and certificates of the efficacy of the method to be produced to the Society on or before the last Tuesday in March, 1822.

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3. Comparative Experiments on raising Trees.

Oaks.

24. To the person who shall ascertain in the best manner, by actual experiment, the comparative merits of the different modes of raising Oaks for timber, either from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on a smooth surface, or among bushes, fern, or other cover; or from young plants previously raised in nurseries, and transplanted: regard being had to the expense, growth, and other respective advantages of the several methods;—*the Gold Medal.*

The accounts and proper certificates that not less than one acre has been cultivated in each mode, to be produced to the Society on or before the first Tuesday in February, 1822.

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Walnuts.

25. To the person who shall communicate to the Society an improved mode of propagating the superior varieties of Walnuts, either by budding, grafting, or any other mode, except sowing;—*the Gold Medal.*

Certificates that not fewer than fifty trees have been so raised; with a full account of the method practised, to be produced to the Society on or before the first Tuesday in April, 1822.

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4. Cultivation of Corn and other Plants.

Wheat.

26. For the best set of experiments made on not less than twelve acres, four acres being sown broad-cast, four drilled, and four dibbled (the two latter in equi-distant rows), in order fully to ascertain which is the most advantageous mode of cultivating wheat;—*the Gold Medal.*

It is required that every operation and the expense of each mode of culture be fully described; and that proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce of the corn, the weight per bushel, and also of the straw, be produced to the Society on or before the last Tuesday in February, 1822.

Grass Seeds.

27. To the person who shall raise the greatest quantity of each or any of the following named grass seeds, viz.—Meadow Fox-tail (alopecurus pratensis), Sweet-scented Vernal-grass (anthoxanthum odoratum), Timothy-grass phleum pratense), meadow Fescue grass (festuca pratensis), smooth-stalked Meadow-grass (poa pratensis), rough-stalked Meadow-grass (poa trivialis), rough Cock's-foot (dactylis glomerata), perennial Ray-grass (lollium perenne);—*the Silver Medal.*

It is required that certificates from persons who have viewed them in a proper state to identify that they are one or other of the seeds above-mentioned, indicating clearly the particular species, and noticing the quantity produced of such seeds, free from weeds or mixture of other grasses, together with proper samples of the seeds, be produced to the Society on or before the first day of March, 1822.

Beans.

28. To the person who shall discover and cultivate, either by the drill or dibbling method, on not less than five acres, a species of Horse-beans or Tick-beans that will ripen their seeds before the 21st of August;—*the Silver Medal.*

It is required that a particular account of the bean, the cultivation, and the expense attending it, with proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce, the weight per Winchester bushel, and a sample of not less than a peck, be produced to the Society on or before the last Tuesday in February, 1822. It is apprehended that if a Bean should be brought into cultivation with the habits of hotspur or other early peas, it would in a great measure escape the danger arising from the collier insect, or other insects, and allow more time for the farmers to till the land for the subsequent crop of wheat.

Parsnips.

29. To the person who shall cultivate the greatest quantity of land, not less than five acres, with Parsnips, for the particular purpose of feeding cattle or sheep;—*the Gold Medal.*

Certificates of the quantity of land so cultivated, with a particular account of the nature of the soil and weight of the produce on sixteen perches, and also of the condition of the cattle or sheep fed with the Parsnips, and the advantages resulting from the practice, to be produced to the Society on or before the last Tuesday in February, 1822.

Potatoes.

30. To the person who shall, in the year 1822, cultivate the greatest quantity of land, not less than fifty acres, with Potatoes of such qualities as shall be fit for the use of the table in the months of April, May, and June, 1823;—*the Gold Medal*, or *Thirty Guineas.*

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Proper certificates, along with other necessary particulars, to be delivered in to the Society on or before the first Tuesday in Nov. 1823.

Hemp.

31. The Society, wishing to encourage the growth of Hemp, in every part of the united empire, for the use of the navy, offer to the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the greatest quantity of land in any part of the united empire, not less than fifty acres statute measure in the year 1821, and at the proper season shall have caused to be plucked the summer Hemp (or male Hemp bearing no seed), and continue the winter Hemp (or female Hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal.*

32. To the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the next greatest quantity of land in any part of the united empire, not less than twenty-five acres, statute measure, in the year 1821, and shall at the proper season cause the same to be plucked as above-mentioned;—*the Silver Medal.*

Certificates of the number of acres, of the distance of the drills, of the plucking of the Hemp, with a general account of the soil, cultivation, and produce, to be delivered to the Society along with fourteen pounds of the Hemp and two quarts of the seed, on or before the last Tuesday in February, 1822.

N. B. The two preceding premiums are continued for one year longer on the same conditions.

Cultivation of the white Poppy (Papaver somniferum) and Extraction of the Opium.

33. To the person who shall obtain the greatest quantity of Opium, not less than 20 lbs. from the white Poppy (Papaver somniferum), raised by the claimant, in Great Britain or Ireland, in the year 1821;—*the Gold Ceres Medal*, or *Thirty Guineas.*

Certificates of the quantity and quality of the produce, with specimens, and a full description of the mode of culture, and of the extraction and preparation of the Opium, to be sent to the Society on or before the first Tuesday in February, 1822.

34. The above premium is extended to the succeeding year on similar conditions.

Persons proposing to claim the above premium are referred to Mr. Young's communications on the subject, published in the 37th and 38th Vols. of the Society's Transactions.

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5. Preservation of Vegetable Produce.

Preserving Turnips, Carrots, Parsnips, Beets, or Mangel Worzel.

35. To the person who shall discover to the Society the best and cheapest method of preserving these roots perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal.*

It is required that a full and accurate account of the method employed, and the expense attending the process, together with certificates that the produce of four acres, at the least, has been preserved according to the method described, and applied to the feeding of sheep and neat cattle; that the whole were drawn out of the ground before the first day of February, in order to clear the greater part of it previous to its being prepared for corn, and to save the soil from being exhausted by the turnips or other roots, and also of the weight of an average sixteen perches of the crop; be produced to the Society on or before the last Tuesday in April, 1822.

36. For the next in quantity and merit, on not less than two acres;—*the Silver Medal.*

Preserving Cabbages.

37. To the person who shall discover to the Society the best and cheapest method of preserving drum-headed Cabbages perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal.*

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38. For the next in quantity and merit, on not less than two acres;—*the Silver Medal.*

Conditions the same as for preserving turnips, Art. 35.—And the accounts to be produced on or before the last Tuesday in April, 1822.

Harvesting Corn in Wet Weather.

39. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of Harvesting Corn in Wet Weather;—*the Gold Medal.*

A full account of the method employed, and of the expense attending the process, with not less than two sheaves of the corn, and certificates that at the least the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the samples; to be produced to the Society on or before the first Tuesday in February, 1822.

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6. Destroying Insects and other Vermin.

Destroying the Grub of the Cockchafer.

40. To the person who shall discover to the Society, an effectual method, verified by repeated and satisfactory trials, of destroying the Grub of the Cockchafer, or of preventing or checking the destructive effects which always result from the attack of these insects on corn, peas, beans, and turnips;—*the Gold Medal.*

The accounts, with proper certificates, to be produced on or before the first Tuesday in February, 1822.

Destroying Worms.

41. To the person who shall discover to the Society, an effectual method, verified by repeated and satisfactory trials, of destroying worms, or of preventing the destructive effects they occasion on corn, beans, peas, or other pulse;—*the Silver Medal.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in February, 1822.

Destroying the Fly on Hops.

42. To the person who shall discover to the Society an easy and efficacious method of destroying the Fly on Hops, superior to any hitherto known;—*the Gold Medal.*

Accounts and certificates of the method having been successfully practised on not less than four acres of Hop ground; to be delivered to the Society on or before the first Tuesday in February, 1822.

Preventing the Blight on Fruit Trees and Culinary Plants.

43. To the person who shall discover to the Society the most effectual method of preventing the Blight or ravages of Insects, on Fruit Trees and Culinary Plants, superior to any hitherto known or practised, and verified by actual and comparative experiments;—*the Gold Medal.*

The accounts, with proper certificates, to be delivered to the Society on or before the last Tuesday in February, 1822.

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7. Cattle and Sheep.

Feeding Cattle.

44. For the best experiments on Stall feeding of Cattle (not fewer than five head), to be continued for the space of twelve months, in order to prove the earliest maturity and greatest propensity to fatten, of the most approved breeds of cattle in Great Britain, or Ireland, specifying the nature of the food given, together with the daily consumption of each beast, with its weekly increase in weight, and such other observations as may be deemed of consequence;—*the Gold Medal.*

A full account of the methods employed, and of the expenses attending the same, and certificates of the sundry matters stated, to be produced on or before the second Tuesday in Feb. 1822.

Protecting Sheep.

45. To the person who, in the winter 1821—1822, shall have protected the greatest number of sheep, not fewer

than one hundred, by hovels, sheds, or any other means;—*the Gold Medal.*

A particular account of the experiments made, with the advantages arising therefrom, together with the expense, and certificates of its utility, to be produced to the Society on or before the first Tuesday in March, 1822.

N. B. It is required that the certificates shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time; together with the general method of managing them.

Cure of the Rot in Sheep.

46. To the person who shall discover to the Society the best and most effectual method of curing the Rot in Sheep, verified by repeated and satisfactory experiments;—*the Gold Medal.*

It is expected that the Candidates furnish accurate accounts of the symptoms and cure of the disease, together with the imputed cause thereof, and the actual or probable means of prevention, which, with proper certificates, must be delivered to the Society on or before the last Tuesday in February, 1822.

Cure of the Foot-Rot in Sheep.

47. To the person who shall discover to the Society the best and most effectual method of curing the Foot-rot in sheep;—*the Silver Medal.*

It is required that the cure be ascertained by repeated and satisfactory experiments, and the method of performing it be verified by proper certificates, delivered to the Society on or before the last Tuesday in February, 1822.

Preventing the ill-effects of Flies on Sheep.

48. To the person who shall discover to the Society the most effectual method of protecting sheep from being disturbed and injured by flies;—*the Silver Medal.*

It is required that the method be ascertained by repeated experiments, and that a certificate of its efficacy be delivered to the Society on or before the first Tuesday in February, 1822.

8. Bees.

49. To the person who shall erect, previous to the first day of September, 1820, an apiary, containing the greatest number and heaviest hives or boxes stocked with Bees, not less than one hundred;—*the Silver Medal,* or *Twenty Guineas.*

50. For the next greatest number, not fewer than fifty stocks;—*Ten Guineas.*

51. For the next greatest number, not fewer than twenty-five stocks;—*Five Guineas.*

Proper certificates of the number of stocks, and that they have been in the possession of the claimant during the preceding summer, to be produced to the Society on or before the first Tuesday in March, 1822.

It is expected that the claimant will give such particular information on the subject, as may tend to benefit the public, and enable other persons to keep Bees to advantage; also that improved methods be made use of in their management.

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9. Agricultural Machines.

Irrigation of Land.

52. To the person who shall discover to the Society the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land superior to, and cheaper than any other method now in use;—*the Gold Medal,* or *Fifty Guineas.*

A model, on a scale of one inch to a foot, with certificates that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it was raised, to be produced to the Society on or before the first of March, 1822.

Paring Plough.

53. To the person who shall invent and produce to the Society a Machine or Plough for the purpose of Paring land preparatory to burning, superior to any hitherto known or in use for such purpose, and to be worked by not more than one man and two horses;—*the Silver Medal,* or *Twenty Guineas.*

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The machine and certificates that at least ten acres have been pared by it in a proper manner, to be produced to the Society on or before the first of February, 1822.

Dibbling Machine.

54. To the person who shall invent a machine, superior to any hitherto known or in use, to answer the purpose of dibbling wheat, by which the holes for receiving the grain may be made at equal distances and proper depths;—*the Silver Medal*, or *Fifteen Guineas.*

The Machine with certificates that at least three acres have been dibbled by it, to be produced to the Society on or before the second Tuesday in February, 1822.

Thrashing Machine.

55. To the person who shall invent a Machine by which corn of all sorts may be thrashed more expeditiously, effectually, and at a less expense, than by any method now in use;—*the Gold Medal.*

The Machine, or a Model, with proper certificates that such a Machine has been usefully applied, that at least thirty quarters have been thrashed by it, and of the time employed in the operation, to be produced to the Society on or before the last Tuesday in February, 1822.

PREMIUMS

FOR THE PRACTICAL APPLICATION OF DISCOVERIES AND IMPROVEMENTS IN

CHEMISTRY, DYEING, AND MINERALOGY.

Increasing Steam.

56. To the person who shall invent and discover to the Society a method, verified by actual experiment, of increasing the quantity or force of Steam in Steam Engines, with less fuel than has hitherto been employed, provided that in general the whole amount of the expenses in using steam engines may be considerably lessened;—*the Gold Medal*, or *Fifty Guineas.*

To be communicated to the Society on or before the last Tuesday in February 1822.

Prevention of Smoke.

57. To the person who shall invent and produce to the Society the best and easiest means, superior to any now before the public, of preventing the emission of dense Smoke, from the chimnies of steam-engines, breweries, and manufactories;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the means proposed have been found to succeed in practice, to be produced to the Society on or before the first Tuesday in February, 1822.

Test for Arsenic.

58. To the person who shall discover to the Society a test for arsenic in solution, superior to any hitherto known;—*the Gold Medal.*

It is required that any communication in claim of this premium shall include a method of detecting arsenic, not only in its usual form of white arsenic, or arsenious acid, but also in the state of arsenic acid, and of the soluble salts formed by the combination of arsenious and arsenic acids with alkaline substances.

Claims for this premium to be delivered in on or before the last Tuesday in February, 1822.

Preventing the Ill-Effects of Smelting Ores.

59. To the person who shall invent and discover to the Society the most

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effectual method of preventing the ill-effects arising to vegetation and animal life, from the sulphureous, arsenical, or other noxious fumes disengaged in smelting the ores of Copper, Zinc, Lead, Tin, Iron, &c. in the large way, and, if possible, of converting those pernicious fumes to useful purposes, in a manner superior to any hitherto known, or in use;—*the Gold Medal*, or *Fifty Guineas*.

It is required that a full account of the process employed, with certificates of its being successfully carried into effect, be produced to the Society on or before the first Tuesday in March, 1822.

Fine Bar Iron.

60. To the person, who shall make the greatest quantity of Bar-iron, not less than ten tons, with coak, from coak pigs, equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel;—*the Gold Medal*, or *Fifty Guineas*.

Samples, not less than one quarter of a hundred weight, with certificates that the whole quantity is of equal quality, to be produced to the Society on or before the first Tuesday in March, 1822.

Refining Copper from the Ore.

61. To the person who shall discover to the Society a method of separating, purifying, and refining Copper from the Ore, so as to render it fit for those purposes to which fine copper is now applied, and by a process cheaper than and superior to any hitherto known or in use;—*the Gold Medal*, or *Fifty Guineas*.

Certificates that not less than three tons have been so prepared or refined, and a quantity not less than 14 lbs. of the copper so refined, to be produced to the Society on or before the last Tuesday in February, 1822.

Refining Zinc from the Ore.

62. To the person who shall invent and communicate to the Society a process of refining Zinc from the Ore superior to any hitherto known or in use, and fit for the purpose of making fine brass;—*the Gold Medal*, or *Fifty Guineas*.

Conditions the same as in the preceding premium.

Preparing Brass.

63. To the person who shall discover a method of making Brass from materials the produce of Great Britain or Ireland, of superior quality to that commonly manufactured in this country, and equal to foreign brass;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, and of the ingredients employed, together with their proportions, and certificates that one ton has been so manufactured, and a sample of the brass, not less than 14 lbs. to be produced to the Society on or before the last Tuesday in February, 1822.

Improved Earthenware Crucibles.

64. To the person who shall invent and discover to the Society a process for manufacturing earthenware crucibles which shall be capable of enduring higher degrees of heat than those now in use, and shall not be too expensive;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, and of the materials employed, with satisfactory certificates of the crucibles having been found to answer in use, and specimens of the crucibles, to be produced to the Society on or before the last Tuesday in March, 1822.

Preparation of Sulphuric Acid, from Sulphur, without the Use of any Nitric Salt.

65. To the person who shall prepare the largest quantity (not less than one ton) of Sulphuric Acid from sulphur, without any nitric salt, of a specific gravity not inferior to the best sulphuric acid of commerce;—*the Gold Medal*, or *Fifty Guineas*.

Certificates that not less than the above quantity of such an acid has been prepared, together with a sample, and a

full account of the process employed, to be produced to the Society on or before the first Tuesday in February, 1822.

Purification of Coal Gas.

66. To the person who shall discover the cheapest method of purifying the inflammable gas procured from coal, superior to any method now in use;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, with certificates of its fully answering the intended purpose, to be produced to the Society on or before the second Tuesday in February, 1822.

Refining Whale or Seal Oil.

67. For disclosing to the Society an effectual method of purifying Whale or Seal Oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil; provided that such purified oil resists congelation in an equal degree with the unpurified;—*the Gold Medal*, or *Fifty Guineas.*

It is required that the whole of the process be fully and fairly disclosed, in order that satisfactory experiments may be made by the Society to determine the validity of the claim; and certificates that not less than twenty gallons have been purified according to the process delivered in, together with two gallons of the oil in its unpurified state, and two gallons so refined, to be produced to the Society on or before the second Tuesday in February, 1822.

Superior Oil for Chronometers and Watches.

68. To the person who shall invent and discover to the Society the best method of distinguishing the kind of oil fittest for chronometers and watches, ascertained by actual experiment; or for a superior method of rendering oil more fit for the above purpose than any hitherto in use, and particularly in rendering it less liable to become thick or rancid;—*the Gold Medal*, or *Fifty Guineas.*

A full account of the experiments and of the process or processes employed, verified by satisfactory certificates, together with a specimen of the oil, to be produced to the Society on or before the last Tuesday in March, 1822.

Glazing common Red Earthenware without Lead or Arsenic.

69. To the person who shall discover to the Society, the cheapest, safest, most durable, and most easily fusible, composition, fit for the purpose of glazing common red Earthenware, without any preparation of lead, arsenic, or other pernicious ingredients, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

Specimens of the ware so glazed, with proper certificates of its having succeeded, and a sample of the materials made use of, to be produced to the Society on or before the first Tuesday in February, 1822.

Crown Glass.

70. To the person who shall make Crown or Window Glass equally transparent, and as free from blue and green colour as the best German sheet;—*the Gold Isis Medal*, or *Thirty Guineas.*

Certificates that not less than two cwt. has been made, together with one whole plate and two of the largest squares that can be cut, and a full account of the proportions of the ingredients, and of the process of manufacture, to be produced to the Society on or before the last Tuesday in February, 1822.

Flint Glass.

71. To the person who shall make flint glass free from veins, and as dense and transparent as the best now in use, and quite fit for the purposes of Opticians;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, with certificates that not less than two cwt. has been made, together with 20 lbs. in plates not less than six inches wide and three quarters of an inch thick,

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to be produced to the Society on or before the last Tuesday in January, 1822.

Indelible Ink.

72. To the person who shall discover to the Society a method of making a Black Ink proper for writing, superior to any at present known, indestructible by chemical applications, and not materially dearer than that which is now in common use;—*the Silver Medal*, or *Fifteen Guineas.*

Certificates that not less than two gallons of such ink have been actually prepared, and found to possess the qualities above-mentioned, with a full detail of the process of making it, and two quarts of the ink to be delivered to the Society on or before the second Tuesday in February, 1822.

Printers' Ink.

73. To the person who shall invent and discover to the Society the best composition for Printers' Ink, superior to any hitherto known or in use;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that 112 lbs. of such ink have been made, with a full account of the process employed, and 6 lbs. of the ink, to be produced to the Society on or before the last Tuesday in February, 1822.

Copper Plate Printers' Ink.

74. To the person who shall invent and discover to the Society the best composition, superior to any hitherto known or in use, and fit for the finest kind of copper-plate printing;—*the Gold Medal*, or *Thirty Guineas.*

Certificates and conditions the same as for the last premium.

Rendering Leather Water-proof.

75. To the person who shall discover a method, superior to any now in use, and of moderate price, of rendering Leather Water-proof, without injuring its texture or pliability;—*the Silver Medal*, or *Fifteen Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the leather in its unprepared and prepared state, to be produced to the Society on or before the last Tuesday in February, 1822.

Hardening Tallow for Candles.

76. To the person who shall discover to the Society a method of hardening or otherwise preparing Tallow, so that candles may be made of it which will burn as clear and with as small a wick as wax candles, without running, and may be afforded at a less expense than any at present made with spermaceti;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that 112 lbs. of such tallow have been made into candles, and 12 lbs. of the candles made thereof, to be produced to the Society on or before the second Tuesday in February, 1822.

Preserving Seeds of Vegetables.

77. For the best method of preserving Seeds of Plants in a state fit for vegetation a longer time than has hitherto been practised, such method being superior to any known to the public, and verified by sufficient trial, to be communicated to the Society on or before the last Tuesday in December, 1822;—*the Gold Medal*, or *Thirty Guineas.*

Preserving Provisions by Salt or by other means, from becoming rancid or rusty.

78. To the person who shall discover to the Society the best, cheapest, and most efficacious method of preserving Salted Provisions from becoming rancid or rusty;—*the Gold Medal*, or *Thirty Guineas.*

A full description of the method, with proper certificates that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society on or before the last Tuesday in February, 1822.

Preserving Iron from Rust.

79. To the person who shall invent and discover to the Society a cheap com-

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position superior to any now in use, which shall effectually preserve Wrought Iron from rust;—*the Gold Medal*, or *Fifty Guineas.*

A full description of the method of preparing the composition, with certificates that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, to be produced to the Society, with ten pounds weight of the composition, on or before the last Tuesday in January, 1822.

Preventing the Dry-rot in Timber.

80. To the person who shall discover to the Society a certain method of preventing the Dry-rot in Timber, superior to any hitherto known;—*the Gold Medal*, or *Thirty Guineas.*

The particulars of the method of prevention, confirmed by repeated experiments, to be produced to the Society on or before the last Tuesday in February, 1822.

Note.—For a method of curing and preventing the dry-rot in ship timber see Mr. Bowden's communication in Vol. 36 of the Society's Transactions.

Preventing the Destructive Effects from Moths.

81. To the person who shall discover to the Society a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the destructive effects occasioned by Moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised;—*the Gold Medal*, or *Thirty Guineas.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in January, 1822.

Substitute for Lead Pipes.

82. To the person who shall invent and produce to the Society, a Substitute for the Lead Pipes used for conveying malt and other liquors from the cellars to the bars of public-houses;—*the Gold Medal*, or *Fifty Guineas.*

The substance of which the Pipe is made must be free from any poisonous or noxious quality, equally durable as lead, and of a moderate expense; and a specimen thereof, not less than ten yards in length, with a complete description of the process employed in forming it, must be produced to the Society on or before the last Tuesday in February, 1822.

Substitute for the Basis of White Paint.

83. To the person who shall produce to the Society the best substitute, superior to any hitherto known, for the basis of white paint, equally proper for the purpose as the white lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white-lead;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than 25 lbs. weight, with an account of the process used in preparing it, and certificates that at least one hundred weight has been manufactured, to be produced to the Society on or before the first Tuesday in February, 1822.

Substitute for Tar.

84. To the person who shall invent and discover to the Society the best substitute for Stockholm tar, equal in all its properties to the best of that kind, and prepared from materials the produce of the United Kingdom, or its colonies;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than one hundred weight, with certificates that at least one ton has been manufactured, and that it can be afforded at a price not exceeding that of the best foreign tar, together with an account of the process, to be delivered to the Society on or before the first Tuesday in March, 1822.

N. B.—Considerable quantities of tar are produced in Sweden and Norway from the roots of fir-trees burnt for that purpose.

Turpentine from the Scotch Fir, or Pinus Sylvestris.

85. To the person who shall prepare in Great Britain the greatest quantity of

Turpentine, not less than two hundred weight, from that species of fir called the Scotch fir, or Pinus sylvestris, Linn.; —*the Gold Medal*, or *Fifty Guineas.*

Certificates of the Turpentine being prepared from such trees of British growth, together with fifty-six pounds of the Turpentine, to be delivered to the Society on or before the second Tuesday in March, 1822.

86. For the next greatest quantity prepared, not less than one hundred weight, on similar conditions;—*the Silver Medal*, or *Twenty Guineas.*

N. B.—The Society being in possession of the method practised for extracting Turpentine from trees whilst growing, and of samples so procured, information will be given upon that subject, on application for that purpose, at the Society's house.

Preparation of Tan.

87. To the person who shall prepare in the most concentrated form, so as to be easily portable, and at a price applicable to the purposes of manufacturers, the largest quantity, not less than one hundred weight, of the astringent principle called Tannin, which abounds in oak bark, and in many other vegetable substances;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the good quality of the quantity so prepared, and a sample of not less than 28 lbs. to be produced to the Society on or before the last Tuesday in February, 1822.

British Indigo.

88. To the person who shall prepare Indigo, or a substance equal to it, from any plants (except woad), the growth of Great Britain or Ireland, at a price not greater than that of foreign indigo of equal quality;—*the Gold Medal*, or *Fifty Guineas.*

A full account of the process and ingredients employed, together with their proportions, and satisfactory certificates that at least one cwt. of the indigo has actually been prepared; also a sample of the same weighing not less than 7 lbs. to be produced to the Society on or before the last Tuesday in February, 1822.

Dyeing Silk or Woollen.

89. To the person who shall discover a method of dyeing Silk or Woollen, of any colour, superior to the same produced by other British dyers, and equal to those produced by the Continental dyers;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk and woollen in its undyed and dyed state, to be produced to the Society on or before the first Tuesday in March, 1822.

Improved Black Dye for Silk or Wool.

90. To the person who shall invent and discover to the Society a black dye for silk or wool superior in colour and durability to any at present in use;—*the Gold Medal*, or *Fifty Guineas.*

This premium is more immediately intended for the improvement of those colours known by the name of blue blacks.

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk or wool so dyed, to be produced to the Society, on or before the last Tuesday in March, 1822.

Dying with Lac Lake.

91. To the person who shall invent and discover to the Society a process for dyeing silk, wool, or cotton with lac lake, superior to any now in use;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, with certificates that it has been found to answer completely in use, and specimens of articles so dyed, to be produced to the Society on or before the last Tuesday in March, 1822.

Preparation of a Red Stain for Cotton Cloth.

92. To the person who shall communicate to the Society the most effectual method of printing or staining cotton cloth with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder;—*the Gold Medal*, or *Fifty Guineas.*

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Certificates that the process, has been advantageously used on ten pieces of calico, each twenty-one yards or upwards in length; one piece of the calico so printed, one pound of the colour, and a full account of the preparation and application, to be produced to the Society on or before the second Tuesday in February, 1822.

Preparation of a Green Colour for printing Cotton Cloth.

93. To the person who shall communicate to the Society the best method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld, and the solutions of indigo;—*the Gold Medal*, or *Fifty Guineas.*

Certificates and conditions as for Premium 92.

Permanent White Paint for the Use of Artists.

94. To the person who shall produce to the Society a White Paint for oil, superior to any hitherto known, and not liable to be discoloured by exposure to light or to sulphuretted hydrogen gas;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and 1 lb. of the colour to be produced to the Society, on or before the second Tuesday in February, 1822.

Red Pigment.

95. To the person who shall discover to the Society a full and satisfactory process for preparing a Red Pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable;—*the Gold Medal*, or *Fifty Guineas.*

One pound weight of such colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1822.

N. B. It is required, that the colour should remain unaltered by the common exposure to strong light, damps, and noxious vapours.

Ultramarine.

96. To the person who shall prepare an artificial Ultramarine, equal in colour, brilliancy, and durability, to the best prepared from lapis lazuli, and which may be afforded at a cheaper rate;—*the Gold Medal*, or *Thirty Guineas.*

The conditions are the same as in the preceding premium for the red pigment.

Colourless Lac Varnish.

97. To the person who shall produce to the Society a Lac Varnish equally hard with that made from shell or seed lac, and as fit for use in the arts, but deprived of its colouring matter;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process, and one quart of the varnish to be produced to the Society on or before the second Tuesday in January, 1822.

Statuary Marble.

98. To the person who shall discover within Great Britain or Ireland, a quarry of White Marble fit for the purposes of statuary, and equal to those kinds now imported from Italy;—*the Gold Medal*, or *One Hundred Guineas.*

A block of at least three feet in length, two in height, and two in width, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the first Tuesday in February, 1822.

N. B. In order to prevent useless expense or trouble to the Claimant in forwarding so large a block, the Society will be ready to examine any smaller specimen of the marble and express their opinion of its value to the Candidate before the block required by the above premium is produced.

Stone for Lithography.

99. To the person who shall discover within Great Britain or Ireland, a quarry of stone fit for the purposes of Lithography, equal at least to the stones imported from abroad;—*the Gold Isis Medal*, or *Thirty Guineas.*

A specimen of the stone at least two feet square and two inches in thickness, with an account of the situation

of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the last Tuesday in February, 1822.

Mineralogical and Geological County Maps.

100. To the person who shall complete and publish the best Mineralogical and Geological Map of any County in the United Kingdom, on a scale of not less than one inch to a mile, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced, with sections of the strata;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the accuracy of such maps, together with the maps, to be produced to the Society on or before the first Tuesday in February, 1822. The maps to remain the property of the Society.

Mineralogical and Geological Map of Ireland.

101. To the person who shall complete and publish an accurate Mineralogical and Geological Map of Ireland, on a scale of not less than five miles to an inch, containing particulars described in the foregoing premium;—*the Gold Medal*, or *Fifty Guineas.*

Mineralogical and Geological Map of Scotland.

102. The same premium is offered for a Mineralogical and Geological Map of Scotland, on similar conditions.

Natural History.

103. To the author who shall publish in the year 1821, the Natural History of any county in the United Kingdom;—*the Gold Medal*, or *Fifty Guineas.*

It is required that the several natural productions, animal, vegetable, and mineral, peculiar to the county, or found therein, be carefully and scientifically arranged and described, in order that the public may be enabled to judge what arts or manufactures are most likely to succeed in such county. A copy of the work to be delivered to the Society on or before the last Tuesday in February, 1822, to remain the property of the Society.

PREMIUMS IN POLITE ARTS.

Honorary Premiums for Nobility.

104. For the best Original Painting or Drawing of any kind, by gentlemen under the age of twenty-one, sons or grandsons of peers or peeresses in their own right, of Great Britain or Ireland;—*the Gold Medal.*

105. For the best Copy on similar conditions;—*the Silver Medal.*

106. For the best Original Painting or Drawing of any kind, by ladies under the age of twenty-one; daughters or grand-daughters of peers or peeresses in their own right, of Great Britain or Ireland;—*the Gold Medal.*

107. For the best Copy on similar conditions;—*the Silver Medal.*

Honorary Premiums for Gentlemen or Ladies.

108. For the best Original Painting in oil colours by gentlemen under the age of twenty-five;—*the Gold Medal.*

109. For the best Copy in oil colours by gentlemen under the age of twenty-one;—*the Silver Medal.*

110. For the best Original Drawing or Painting in water colours by gentlemen under the age of twenty-five;—*the Gold Medal.*

111. For the best Copy in water colours by gentlemen under the age of twenty-one;—*the Silver Medal.*

112. For the best Original Painting in oil colours, by ladies under the age of twenty-five;—*the Gold Medal.*

113. For the best Copy in oil colours by ladies under the age of twenty-one;—*the Silver Medal.*

114. For the best Original Drawing, or Painting in water-colours, by ladies under the age of twenty-five;—*the Gold Medal.*

115. For the best Copy in water-colours, by ladies under the age of twenty-one;—*the Silver Medal.*

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N. B. As the foregoing honorary premiums are intended only for the nobility and gentry; persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons and daughters of such persons, will not be admitted candidates in the above classes.

PREMIUMS FOR ARTISTS AND OTHERS.

Human Figure.

116. For the best drawing in chalk, pencil, or Indian-ink, copied from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Palette.*

117. For the best outline, drawn from any entire figure of the antique, or cast in plaster—the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot, the size of life—by persons under the age of eighteen;—*the Silver Isis Medal; for the next in merit, the Silver Palette.*

118. For the best finished drawing from any antique figure, or from any cast in plaster—the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot, the size of life, by persons under the age of nineteen—*the Silver Medal; for the next in merit the Silver Isis Medal.*

119. For the best finished drawing of an anatomical human figure—the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot, the size of life, by persons under the age of nineteen;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

120. For the best drawing, from the living figure—the size of the drawing to be not less than twenty-four inches—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

121. For the best original drawing of an historical composition of two or more figures—the principal figure not less than nine inches—by persons under the age of twenty-five;—*the Gold Isis Medal; for the next in merit the Silver Medal.*

122. For the best copy in oil from any historical picture, of two or more figures—the principal figure not less than twenty-four inches—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

123. For the best original painting, being an historical composition; the subject—David staying the hand of Abishai who was about to slay Saul whilst he was sleeping in the Trench, *vid.* 1st Samuel, ch. xxvi.—the principal figure not less than twenty-four inches, by persons under the age of twenty-five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

Heads or Portraits.

124. For the best drawing of a head, copied from any picture, drawing, or print—by persons under the age of sixteen;—*the Silver Palette.*

125. For the best finished drawing of a head, not less than the size of life, from any bust—by persons under the age of eighteen;—*the Silver Isis Medal; for the next in merit the Silver Palette.*

126. For the best original painting in water colours of a portrait—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

127. For the best copy, in oil, from a picture (a portrait)—by persons under the age of nineteen;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

128. For the best original painting in oil of a portrait—by persons under the age of twenty-three;—*the Gold Isis Medal; for the next in merit the Silver Medal.*

Models.

129. For the best model in bass-relief, from any entire antique figure, or cast in plaster, the size of the model not less

than twenty-four inches, by persons under the age of eighteen;—*the Silver Palette.*

130. For the best model in bass-relief from the living figure, by persons under the age of twenty-one, the model not less than twenty-four inches;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

131. For the best restored model of the Ilissus in the Elgin collection—the size of the model not less than three feet—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

132. For the best original model of a group—the figures not less than twenty-four inches—by persons under the age of twenty-five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

Landscape.

133. For the best drawing of a landscape, copied from any picture, drawing, or print—by persons under the age of eighteen;—*the Silver Palette.*

134. For the best original drawing of a landscape from nature—by persons under the age of twenty-one;—*the Silver Isis Medal; for the next in merit the Silver Palette.*

135. For the best original oil painting of a landscape from nature—by persons under the age of twenty-three;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

136. For the best original composition of a landscape painted in oil—by persons under the age of twenty-five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

Flowers, or Fruit.

137. For the best drawing from any picture, print, or drawing—by persons under the age of sixteen;—*the Silver Palette.*

138. For the best original composition in water colours drawn from nature—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

139. For the best original composition in oil, painted from nature—by persons under the age of twenty five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

Animals.

140. For the best drawing of any animal copied from any picture, print, or drawing—by persons under the age of sixteen;—*the Silver Palette.*

141. For the best original drawing from nature of any animal—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

142. For the best original painting of a group of not less than three animals painted from nature—by persons under the age of twenty-five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

Still Life.

143. For the best original composition, painted in oil or water colours, of three or more of such objects as are usually called Still Life, by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

Architecture.

144. For the best drawing of any public building in the United Kingdom, drawn from actual measurement on a sheet of double elephant paper—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

145. For the best original design in Greek architecture, for a building suitable to the purposes of a court of justice; consisting of plan, elevation, section, and perspective view, to the scale of $\frac{1}{16}$th of an inch to a foot; the drawing to remain the property of the Society, if required—by persons under the age of twenty-five;—*the Gold Medallion; for the next in merit the Gold Isis Medal.*

The following inscription to be engraved on these medallions "The premium given by the Society for the encouragement of Arts, Manufactures, and Commerce, in conformity to the will of John Stock, esq. of Hampstead."

146. For the best original design in Gothic architecture for any public building, with a plan, elevation, section, and perspective view—each drawn on a sheet of large elephant paper—by persons under the age of twenty-five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

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Perspective.

147. For the best perspective drawing from any public building in the United Kingdom, from elevations taken by actual measurement, and projected according to rule, drawn on large elephant paper—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

148. For the best perspective drawing of machinery—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

Enamel Painting.

149. For the best enamel painting of a head—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

150. For the best historical painting in enamel—by persons under the age of twenty-five;—*the Gold Medal; for the next in merit the Gold Isis Medal.*

Carving in Wood.

151. For the best carving in Wood, of fruit, or flowers, not less than nine inches high—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

152. For the best carving in wood, of one or more animals, the size of the animal not less than six inches—by persons under the age of twenty-one;—*the Silver Medal; for the next in merit the Silver Isis Medal.*

153. For the best carving in wood, of one or more human figures, not less than a foot in height—by persons under the age of twenty-five;—*the Gold Isis Medal; for the next in merit the Silver Medal.*

Etching of an Historical Subject.

154. For the best free Etching in historical composition, from a picture of eminence;—*the Gold Isis Medal.*

Etching of a Landscape.

155. For the best free Etching of a Landscape, from a picture of eminence;—*the Silver Medal.*

Historical Engravings.

156. For the best finished Engraving in historical composition;—*the Gold Medal.*

Landscape Engraving.

157. For the best finished Engraving of a Landscape;—*the Gold Isis Medal.*

Engraving of a Portrait.

158. For the best finished Engraving of a Portrait;—*the Gold Isis Medal.*

N. B. In the class of finished Engravings the Society requires an aquafortis impression, and a finished proof to be sent, and to remain with the Society.

Engraving on Steel.

158. For the best specimen of engraving on a steel plate not less than 5 inches by 3 inches in area, and not exceeding ¼th of an inch in thickness; the plate to be afterwards hardened without injuring the engraving;—*the Gold Medal.*

The Plate, with two impressions from it, both in its soft and hardened state, to be produced to the Society. The impressions, but not the plate, to remain the property of the Society.

Engraving on Wood or Metal Blocks.

159. For the best Engraving on Wood or Metal Blocks, of an historical subject, the size of the principal figure not less than six inches in height, and the Block to be at least twelve inches by nine;—*the Gold Isis Medal.*

Two or more impressions, with the Block, to be produced to the Society. The impressions, but not the Block, to remain the property of the Society.

Prevention of Forgery.

160. To the person who shall communicate to the Society, the best method of preventing the impressions of prints from being transferred from the paper to plates or blocks for the purpose of being etched or engraved;—*the Silver Medal*, or *Twenty Guineas.*

The communication, with a full description of the process, and of the materials employed, together with the spe-

cimens, to be sent to the Society on or before the last Tuesday in February, 1822.

As this premium is intended to increase the difficulty of forging Bank Notes, and other kinds of paper currency, it is required, that the process shall not be too difficult or expensive for general use.

Lithography.

161. For the best specimen in this art;—*the Silver Medal.*

A particular account of the process employed, with six impressions of the drawing, to be produced to the Society.

Medal Die Engravings.

162. For the best Die Engraving either of a single figure or group, after the engraver's own design and model;—*the Gold Medal.*

163. For the best Die Engraving of a head;—*the Gold Isis Medal.*

The Dies with two impressions or casts, and the model, in each claim for Medal Die sinking are to be produced to the Society, and the impressions or casts to remain the property of the Society.

Conditions for the Polite Arts.

All performances in the class of Polite Arts, whether for claims or bounties, are to be produced to the Society on or before the first Tuesday in March, 1822, and none can be received after that day.

No Candidate, under any pretence whatever, shall be allowed to retouch or varnish a performance after it has been received by the Society.

No person having received a premium or bounty, shall afterwards receive an equal or inferior one in the same department of art.

No more than one performance in each class shall be received from the same Candidate.

All performances to which premiums or bounties are adjudged shall remain with the Society until after the second Wednesday in June, 1822, when they will be re-delivered, unless mentioned in the premiums to the contrary.

No performance shall be admitted, that has obtained a reward from any other society, or academy.

No performance can be received with a view to obtain a bounty, which could have come into any of the foregoing classes.

It is required, that the subjects for which premiums are offered, be delivered in without the names, or any external intimation to whom they belong; that the claimant affix on the front of his performance whatever mark he pleases, and that the same mark be inscribed on a paper sealed up, containing within, the name and residence of the Candidate, and *on the outside* the age and sex, and the number of the premium in claim of which the performance is offered; the name not to be disclosed unless the Candidate be successful, or in consequence of a special vote of the Society, or Committee.

To encourage real merit, and to prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the Candidate, the Society require a specimen of the abilities of each successful candidate to be made under the inspection of the Committee of Polite Arts.

All Candidates in the Polite Arts are required to signify on their drawings, whether the performances are originals or copies; and if possible to send the originals from which the copies are taken.

All copies of drawings, &c. are to be on a different scale from the original.

The Society reserve to themselves the power of giving a Medal of less value than the premium offered, or of withholding the same altogether in cases where the performance shall be deemed undeserving of reward.

In consideration of the great number of premiums here offered, embracing so many departments of the Fine Arts, no bounty will be given to any performance comprised in any of the classes, from No. 116, to No. 163 inclusive.

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PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

Cloth from Hop Stalks, Nettles, &c.

164. To the person who shall produce to the Society the greatest quantity, not less than thirty yards, of cloth, at least 27 inches wide, made in Great Britain or Ireland, of Hop Stalks or Bines, Nettles, or other raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and which can be generally afforded as cheap as cloth of equal quality and appearance now made from hemp, flax, or cotton, and much finer in quality than any hitherto manufactured in England from Hop Stalks, &c.;—*the Gold Medal*, or *Thirty Guineas.*

One pound of the thread of which the Cloth is made, and thirty yards of the Cloth, together with proper certificates that the whole is manufactured from Hop Stalks, or Bines, &c. to be produced to the Society on or before the last Tuesday in February, 1822.

N. B. The Society is already in the possession of Cloth made in England from Hop Stalks or Bines, and Nettles, which may be inspected by application to the house-keeper.

Sheep's Wool.

165. To the person who shall prove to the Society, that he has sold the largest quantity of Merino Wool, or such Wool as will answer the same purpose, being the produce of his own flock, in the United Kingdom, for the purpose of being manufactured into superfine cloth, the quantity of Wool not less than five hundred weight, in the year 1821;—*the Gold Medal.*

Certificates, along with samples of the wool, and of the cloth manufactured from it to be produced to the Society on or before the last Tuesday in March, 1822.

166. For the next greatest quantity, not less than two hundred and fifty pounds;—*the Silver Medal*, on similar conditions.

Wicks for Candles or Lamps.

167. To the person who shall discover to the Society, a method of manufacturing Hop-stalks or Bines, Nettles, or any other cheap material, the growth of the United Kingdom, so as to render them equally fit for the purpose of supplying the place of cotton, for Wicks of Candles or Lamps;—*the Silver Medal*, or *Twenty Guineas.*

Samples, not less than 5 lbs. weight, of the Wicks so prepared, to be produced to the Society on or before the last Tuesday in February, 1821, with certificates that the whole quantity is equal in quality to the sample.

Wicks for Candles.

168. To the person who shall make known to the Society the most satisfactory result of a series of experiments actually made by him to determine the best thickness of Cotton Wicks for Candles, so as to obviate the defects of those commonly used;—*the Silver Medal*, or *Ten Guineas.*

Certificates, that not less than one hundred weight have been so made, and six pounds of the Candles, to be produced to the Society, on or before the last Tuesday in February, 1822.

N. B. The intention in offering this premium is, to ascertain the proper thickness or bulk of the Wick in proportion to that of the tallow, and to remove the unpleasant consequences and waste arising from the sparkling, or guttering of the candles in common use.

Paper from Raw vegetable Substances.

169. To the person who shall, between the first of January, 1821, and the first of January, 1822, make the greatest quantity, and of the best quality (not less than ten reams) of good and useful paper, from raw vegetable substances, the produce of Great Britain or Ireland, superior to any hitherto manufactured from such substances, and

which can be generally afforded as cheap as paper of equal quality and appearance now made from rags;—*the Silver Medal*, or *Twenty Guineas.*

N. B. The object of the Society being to add to the number and quantity of raw materials used in this manufacture, it is their wish to include every useful sort of paper, and to introduce such natural products as can be easily and cheaply procured in great quantities. The Society are in possession of two volumes containing a great variety of specimens of paper made from raw vegetable substances, viz. nettles, potato-haulm, hop-bines, &c. which volumes may be inspected by any person on application to the House-keeper.

Certificates of the making such paper, and one ream of the paper to be produced on or before the second Tuesday in February, 1822.

Transparent Paper.

170. To the person who shall discover to the Society a method of making Paper from the pulp, that shall be perfectly transparent, and of a substance and body equal to foolscap, that shall take and bear common writing-ink with the same facility and correctness as Writing paper generally in use;—*the Silver Medal*, or *Twenty Guineas.*

Certificates of the making such paper, an account of the process, and one ream of the paper, to be produced on or before the second Tuesday in March, 1822.

(India Paper, see page xxxiii.)

Chintz Patterns for Calico Printers.

171. For the best original pattern in a new taste, of light and dark-ground Chintz for garment work, or furniture, fit for the purpose of Calico-printers;—*the Silver Medal.*

To be produced to the Society on or before the first Tuesday in March, 1822, and a copy of the pattern for which the premium is adjudged, to remain the property of the Society.

Copper-plate Patterns.

172. For the best pattern, in a new style, fit for the purpose of calico-printers for garment-work or furniture;—*the Silver Medal.*

To be produced to the Society on or before the first Tuesday in March, 1822, and a copy of the pattern for which the premium is adjudged, to remain the property of the Society.

Gloves.

173. To the person who shall make known to the Society a process equal or superior to that of the French, for preparing, dyeing, and finishing the skins, verified by actual experiments, and the communication accompanied with at least a dozen pair of gloves made from skins so prepared;—*the Gold Medal*, or *Forty Guineas.*

Certificates from competent persons, fully approving of the result of such experiments, together with the gloves and communication, to be produced to the Society on or before the last Tuesday in March, 1822.

Cat-gut.

174. To the person who shall discover to the Society the best method of manufacturing, in the United Kingdom of Great Britain and Ireland, the intestines of sheep, lambs, goats, or of any other animals, into the article called Cat-gut, equally strong, clear, smooth, even, and free from knots, as the best Italian strings, and at a price not exceeding what they are usually sold for in England;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that not less than fifty pound weight have been so prepared by the claimant, with a full detail of the process, and samples of the articles of various thicknesses, to be produced to the Society on or before the first Tuesday in February, 1822.

175. For the next greatest quantity, not less than twenty-five pounds;—*the Silver Medal*, or *Twenty Guineas*, on similar conditions.

Hose for Fire Engines, Brew-houses, &c.

176. To the person who shall invent and make known to the Society a method of making Hose for Fire Engines

Brewhouses, &c. similar to those used on the continent, made of flax or hemp, or other flexible material cheaper than leather;—*the Gold Isis Medal*, or *Thirty Guineas.*

A full account of the process used in manufacturing it, with certificates of its efficacy in practice, to be produced to the Society on or before the last Tuesday in February, 1822.

Thread for Lace.

177. To the person who shall invent or discover a method of manufacturing Thread from flax, of as fine quality as any used on the Continent;—*the Gold Medal*, or *Thirty Guineas.*

Samples of the Thread, not less than one pound in weight, and of the Lace made therefrom, together with certificates that not less than ten pounds in weight of each sort has been manufactured, to be produced to the Society, on or before the last Tuesday in March, 1822.

PREMIUMS IN MECHANICS.

Gunpowder Mills.

178. To the person who shall invent and discover to the Society the most effectual mode of preventing explosions in Gunpowder Mills;—*the Gold Medal*, or *One Hundred Guineas.*

Certificates and accounts of the method having been put in practice in one or more Gunpowder Mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1822.

N. B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of Gunpowder-making which fall short of the total prevention of explosion; such bounty or reward will be bestowed on them as they may appear to merit.

Family or Portable Mill.

179. To the person who shall invent and produce to the Society, a mill for Grinding Corn for the use of private families, or parish poor; the construction to be simple, the mill to be easily worked, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

The Mill, and certificates of its having been used to good effect, to be produced to the Society, on or before the last Tuesday in February, 1822. Cheapness and simplicity will be considered as essential parts of its merit; and the Mill, or a model, to remain with the Society.

Machine for Raising Coals, Ore, &c. &c.

180. To the person who shall invent a machine for raising coals, ore, &c. from mines, superior to any hitherto known or in use; and which shall produce the effect at less expense;—*the Gold Medal*, or *Fifty Guineas.*

A model with a certificate that a machine at large on the same construction has been advantageously used, to be produced to the Society on or before the second Tuesday in February, 1822.

Improved Walking-wheel or Crane.

181. To the person who shall invent an improved Walking Wheel or Crane, on which the weight or power of any person or persons shall be applied with the greatest safety and effect, and so contrived that the power can be varied according to the greater or less weight to be raised or lowered;—*the Gold Medal*, or *Thirty Guineas.*

A model, with a certificate that the machine at large has been employed to good effect, to be produced to the

Society on or before the second Tuesday in March, 1822.

Machine for Raising Water.

182. To the person who shall invent a machine on a better, cheaper, and more simple construction than any hitherto known for raising water out of wells, &c. from a depth of not less than fifty feet;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the performance of the machine, and a model of it, to be produced to the Society, on or before the last Tuesday in February, 1822.

Extinguishing Fires.

183. To the person who shall produce to the Society a method for preventing or extinguishing fire in buildings, superior to any now in use;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the last Tuesday in January, 1822.

Boring and Blasting Rocks.

184. To the person who shall discover to the Society a more simple, safe, cheap, and expeditious method than any hitherto known or in use, of Boring or Blasting Rocks in mines, shafts, wells, &c.;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the first Tuesday in February, 1822.

Heating Rooms for the purpose of Manufacturers.

185. To the person who shall invent and discover to the Society, a method of Heating Rooms, superior to and cheaper than any hitherto known or in use, for the purpose of manufacturers;—*the Gold Medal*, or *Thirty Guineas.*

A model or complete drawing and description of the method, with certificates that it has been successfully practised, to be delivered to the Society on or before the last Tuesday in March, 1822.

Improved Ventilation.

186. To the person who shall invent and produce to the Society a mode of permanently Ventilating the apartments in hospitals, workhouses, and other crowded places, superior to any now known or used;—*the Gold Medal*, or *Fifty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates to be delivered to the Society on or before the last Tuesday in February, 1822.

Ventilating Coal Mines.

187. To the person who shall invent and carry into practice a method of Ventilating coal mines so as effectually to prevent the accidents liable to arise from the accumulation of carburetted hydrogen and other gases;—*the Gold Medal.*

A full account of the process, with certificates of its efficacy, to be produced to the Society on or before the last Tuesday in February, 1822.

N. B. The Society will be very glad to attend to any communication, which, though not completely effecting the object, appears to offer an approximation to it. The Society wish particularly to refer candidates for this premium to the communication made by Mr. Ryan and published in the 34th vol. of the "Transactions," and will consider themselves obliged to any person who will furnish any information with respect to the attempts which have been made to introduce Mr. Ryan's mode of ventilating coal mines into actual use, and of the success with which this method has been attended.

Preventing Accidents from Stage Coaches.

188. To the person who shall invent and discover to the Society a method of preventing accidents arising from Stage Coaches;—*the Gold Medal*, or *Thirty Guineas.*

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Ample certificates of its efficacy, and a description of the method with models of the machinery used, to be produced to the Society on or before the last Tuesday in February, 1822.

N. B. The Society wish to impress strongly on the public the necessity of turning their attention to the above premium, from the number of accidents that daily occur; and suggest whether they might not in some degree be prevented, by an alteration in the manner of placing the luggage.

Preventing Accidents from Horses Falling with Two-Wheeled Carriages.

189. To the person who shall invent and produce to the Society a method, superior to any hitherto known or in use, preventing accidents from the falling of Horses with Two-wheeled Carriages, especially on steep declivities; —*the Gold Medal*, or *Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates that the same has been used with success, to be delivered to the Society, on or before the second Tuesday in February, 1822.

Improving Turnpike and other Roads.

190. To the person who shall discover to the Society the most effectual and cheapest method, verified by actual experiments, of combining the materials ordinarily employed in making or repairing Roads, so as to form them of the hardest consistency by their cementing properties, or by an artificial mixture of earth, stones, &c. altered by heat, or any other mode, so as to form an even, hard, and durable carriage-road;—*the Gold Medal*, or *Thirty Guineas.*

It is required that an accurate account of the method used, and every expense attending it, together with satisfactory certificates of its being effectual, be delivered to the Society on or before the first Tuesday in March, 1822.

Raising the Bodies of Persons who have Sunk under Water.

191. To the person who shall invent and produce to the Society, a cheap and Portable Drag, or other machine, superior to those now in use, for the purpose of taking up, in the best and most expeditious manner, and with the least injury, the bodies of persons who have sunk under water;—*the Gold Medal*, or *Thirty Guineas.*

The drag or machine, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in March, 1822.

Preventing prejudicial effects to the Persons employed in pointing Needles.

192. To the person who shall invent and produce to the Society a mode of obviating the prejudicial effects that attend the operation of Pointing Needles, by grinding them dry, during which the particles of grindstone-dust, and steel, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders;—*the Gold Medal*, or *Thirty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, together with proper certificates of its practicability and adoption, to be delivered to the Society on or before the second Tuesday in March, 1822.

Preventing Explosions in Steam-engine and other covered Boilers.

193. To the person who shall invent and discover to the Society a method of rendering covered boilers used for steam-engines and other purposes, safer than any now in use, and less liable to accidents from explosion;—*the Gold Medal, and not less than Thirty Guineas.*

Ample certificates that the method has been found to answer its intended purpose, to be produced to the Society, on or before the last Tuesday in February, 1822.

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An Original Screw.

194. To the person who shall invent and make known to the Society any mode of producing an original screw more perfect than any hitherto known; —*the Gold Medal*, or *Thirty Guineas.*

A model, or complete drawing and description of the method, with a screw not less than twelve inches in length, to be produced to the Society on or before the last Tuesday in February, 1822.

Working Drawings of a Steam-engine.

195. To the person who shall produce to the Society the best working drawings in plan, elevation, and section of a condensing steam-engine in its most improved state, with a full detail of its several parts, and an accurate description thereof;—*the Gold Vulcan Medal*, or *Thirty Guineas.*

The drawings and description to be produced to the Society on or before the first Tuesday in April, 1822, and if rewarded, to remain the property of the Society.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE.

Taking Whales by the Gun-harpoon.

196. To the person who shall strike and take the greatest number of Whales, not fewer than three, with the Gun-harpoon;—*Ten Guineas.*

Certificates of the striking such Whales, and that they were actually taken in the year 1820, signed by the master, or by the mate when the claim is made by the master, to be produced to the Society on or before the last Tuesday in December, 1821.

Taking Porpoises.

197. To the people in any boat or vessel, who, in the year 1821, shall take the greatest number of Porpoises, not fewer than thirty, on the coast of Great Britain or Ireland, for the purpose of extracting oil from them;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the number, signed by the persons to whom they have been sold or delivered for the purpose of extracting the oil, to be produced to the Society on or before the last Tuesday in February, 1822.

Oil from Porpoises, or Sun Fish.

198. To the person who shall manufacture the greatest quantity of Oil from Porpoises or Sun-fish taken on the coast of Great Britain or Ireland, in the year 1821, not less than twenty tons;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the oil having been made from porpoises or sun-fish actually caught on the coast of Great Britain or Ireland, and two gallons of the oil as a sample, to be produced to the Society on or before the last Tuesday in February, 1822.

Curing Herrings.

199. To the person who shall send to the Society the best sample of White Herrings (not less than a sixteen gallon barrel), with certificates that not less than fifty barrels, equal in all respects to the sample, have been cured in a British or Irish vessel or port, by the person by whom the sample has been sent to the Society;—*the Gold Medal*, or *Fifty Guineas.*

Samples to be produced to the Society, on or before the first Tuesday in January, 1822, with certificates that the conditions of the premium have been fulfilled; together with a full description of the process employed.

In the 37th and 38th volumes of the Transactions, will be found valuable communications from Mr. Denovan of Leith, on the cure of British herrings, to

which the Society particularly wish to direct the attention of such persons as intend to claim this premium.

Exporting British-cured Herrings.

200. To the person who shall import into the Hamburgh or other continental market previous to February, 1822, the greatest quantity of white herrings cured in British or Irish vessels, not less than 500 barrels, in quality at least equal to the best Dutch herrings, and which in the Hamburgh or other continental market shall produce prices at least equal to the best Dutch;—*the Gold Medal*, or *Fifty Guineas.*

201. For the next greatest quantity, not less than 300 barrels;—*the Gold Isis Medal*, or *Thirty Guineas.*

Proper certificates and samples of the herrings to be produced to the Society on or before the last Tuesday in February, 1822.

The same premiums to be continued one year longer on similar conditions.

Curing Mackarel.

202. To the person who shall, before January, 1822, cure the greatest quantity of Mackarel, not less in number than ten thousand, in the best manner and to the satisfaction of the Society, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port;—*the Gold Isis Medal*, or *Twenty-five Guineas.*

203. For the next greatest quantity, not less than five thousand;—*the Silver Medal*, or *Fifteen Guineas.*

A sixteen gallon barrel of the mackarel to be produced to the Society on or before the first Tuesday in January, 1822, with certificates that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimens, together with a full description of the process employed.

The same premiums to be extended one year farther, on similar conditions.

N. B. Specimens of cured mackarel, which promise to afford a most valuable article of trade and food, even superior to herrings, have been sent to the Society, and have induced them to turn the attention of the public thereto, by offering the above premiums.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH COLONIES.

Nutmegs.

204. For the greatest quantity of Merchantable Nutmegs, not less than ten pounds weight, being the growth of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or of the several islands adjacent thereto, and equal to those imported from the islands of the East Indies;—*the Gold Medal*, or *Fifty Guineas.*

Satisfactory certificates, from the governor or commander in chief, of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, to be produced on or before the first Tuesday in January, 1823.

The same premium is offered for the year 1824.

Kali for Barilla.

205. To the person who shall have cultivated, in the Bahama islands, or any other part of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or the several islands adjacent thereto, in the year 1821, the greatest quantity of land, not less than two acres, with a Kali equal to the Spanish Kali for the purpose of making Barilla;—*the Gold Medal*, or *Thirty Guineas.*

206. For the next greatest quantity, not less than one acre;—*the Silver Medal*, or *Fifteen Guineas.*

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Certificates signed by the governor or commander in chief for the time being, of the quantity of land so cultivated, and of the state of the plants at the time of signing such certificates, to be delivered to the Society, with samples of the kali, on or before the second Tuesday in February, 1822.

The same premiums, on similar conditions, will be given for Barilla grown in 1822 and 1823.

Destroying the Insect commonly called the Borer.

207. To the person who shall communicate to the Society an effectual method of destroying the insect commonly called the Borer, which has of late years been so destructive to the sugar canes in the West India islands;—*the Gold Medal*, or *Fifty Guineas.*

The discovery to be ascertained by satisfactory certificates, under the hand and seal of the governor or commander in chief for the time being, and of some other respectable persons, inhabitants of the islands, or other place, in which the remedy has been successfully applied; such certificates to be delivered to the society on or before the first Tuesday in February, 1822.

Cultivation of Hemp in Upper Canada.

208. To the person who shall sow with Hemp the greatest quantity of land in the province of Upper Canada, not less than six arpents (each four-fifths of a statute acre), in the year 1821, and shall at the proper season cause to be plucked the summer Hemp (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal*, or *One Hundred Dollars.*

209. To the person who shall sow with Hemp the next greatest quantity of land in the same province of Upper Canada, not less than five arpents, in the year 1821, in the manner abovementioned; *the Silver Medal*, or *Fifty Dollars.*

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general account whether sown broad cast or in drills, the expense, soil, cultivation and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, together with 28 lbs. of the hemp, and two quarts of the seed, on or before the last Tuesday in April, 1823.

Cultivation of Hemp in Lower Canada.

210 — 211. Premiums exactly similar in all respects to those held out for the province of Upper Canada, are also offered for the province of Lower Canada.

Cultivation of Hemp in Nova Scotia and New Brunswick.

212 — 213. Similar premiums in all respects are also offered to the provinces of Nova Scotia and New Brunswick.

Importation of Hemp from Canada, Nova Scotia, and New Brunswick.

214. To the person who shall import to this country the greatest quantity of Marketable Hemp, not less than one hundred tons, in the year 1821, the produce of Canada, or of one of the abovementioned provinces;—*the Gold Medal.*

215. To the person who shall import the next quantity, not less than fifty tons;—*the Silver Medal.*

Certificates, satisfactory to the Society, to be produced by the master of the vessel on or before the first Tuesday in February, 1822, to testify that such hemp was grown and prepared in Canada, Nova Scotia, or New Brunswick.

Substitute for Hemp.

216. To the person who, in the year 1821, shall discover and produce to the Society a substitute for Hemp, equally cheap, durable, and applicable to all the purposes for which hemp is now used;—*the Gold Medal*, or *Fifty Guineas.*

A quantity of the substitute not less than one hundred weight, together with the proper certificates from the governor or commander in chief, if

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raised in any of the British colonies, or from the Secretary of the Board of Trade, if raised in the East Indies, to prove that the same has been used with success, to be produced to the Society on or before the last Tuesday in February, 1822.

N. B. The premiums from No. 207, to 216, are all extended one year farther, on similar conditions.

Silk.

217. For the greatest quantity of silk proper for manufactures, not less than one hundred pounds weight, produced by any person in the Isle of France, Ceylon, or Malta, or islands near or adjacent thereto, in the possession of Great Britain, in the year 1820, from Silk-worms bred there;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the Silk, not less than one pound, with an account of the method in which the Silk-worms were managed; the kind and size of the mulberry-trees from whence they were furnished with food, and particulars respecting the culture of the mulberry trees for that purpose, to be produced to the Society on or before the first Tuesday in March, 1822.

218. For the next greatest quantity, not less than fifty pounds, on similar conditions;—*the Silver Medal*, or *Twenty Guineas.*

Satisfactory certificates from the governor or commander in chief of the district where the said Silk was produced, and of the several particulars abovementioned, to be delivered to the Society along with the samples required.

N. B. The same premiums, on similar conditions, will be given for Silk produced in the year 1821.

Cocoa Nut Oil.

219. To the person who shall, in the year 1822, import the largest quantity of Cocoa-nut oil, not less than fifty tons, and of the best quality;—*the Gold Medal*, or *Thirty Guineas.*

Proper certificates, with the bills of lading, and samples of the oil, to be produced to the Society on or before the last Tuesday in February, 1822.

This premium is proposed, particularly with a view to encourage the use of Cocoa-nut oil, in the making of gas for the purpose of illumination, such gas having been found much superior to those commonly in use.

Wool from New South Wales.

220. To the person who, previous to February, 1823, shall import into Great Britain or Ireland, the greatest quantity, not less than two tons, of fine wool, the produce of New South Wales;—*the Gold Medal.*

Proper certificates, with the bills of lading, and samples of the wool, to be produced to the Society, on or before the last Tuesday in February, 1823.

221. For the next greatest quantity, not less than one ton, on similar conditions;—*the Silver Medal.*

Fine Wool from New South Wales.

222. To the person who shall produce to the Society the finest sample of wool, the produce of New South Wales, superior to the best Saxon or Spanish;—*the Gold Medal.*

Not less than 14 lbs. of the wool to be produced to the Society on or before the last Tuesday in February, 1823, together with certificates, that at least 5 cwt. equal to the sample has been imported by the claimant.

Extirpating the Stumps and Roots of Trees.

223. To the person who shall invent and discover to the Society the best method, verified by actual experience, of raising out of the earth and removing the stumps and roots of trees which have been left after felling the timber, so as to clear the land for the purposes of cultivation;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the method has succeeded with at least fifty trees of large girth, and a full description of the means employed, to be delivered to the Society on or before the last Tuesday in February, 1822.

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PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH SETTLEMENTS IN THE EAST INDIES.

India Paper for Copper Plate Printing.

224. To the person who shall communicate to the Society the best account of the process employed in India or China for the manufacture of paper used in England for Copper Plate Printing, and known by the name of India Paper, together with an account of the materials from which such paper is made;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the paper, not less than one ream, with samples of the materials in their raw or unmanufactured state, and satisfactory certificates signed by the Secretary of the Government or Board of Trade of the respective settlement, to be produced to the Society on or before the first Tuesday in March, 1823, or 1824.

Bhaugulpore Cotton.

225. To the person who shall import into the port of London, in the year 1820, the greatest quantity, not less than one ton, of the Bhaugulpore Cotton, from which Cloths are made in imitation of nankin, without dying;—*the Gold Medal.*

A quantity of the Cotton not less than five pounds weight in the pod, and five pounds carded, to be produced to the Society, with proper certificates, signed by the Secretary of the Board of Trade of Bengal or Bombay, or by the Governor of the Colony whence the article is exported, on or before the last Tuesday in February, 1822.

Annatto.

226. To the person who, in the year 1821, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of annatto, not less than five-hundred weight;—*the Gold Medal.*

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper certificates, signed by the Secretary of the Board of Trade of the respective settlement, that the annatto is the produce of such settlement, on or before the last Tuesday in February, 1822.

True Cochineal.

227. To the person, who in the year 1821, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of true Cochineal, not less than two hundred weight;—*the Gold Medal.*

A quantity of the Cochineal, not less than three pounds weight, with proper certificates, signed by the Secretary of the Board of Trade of the respective settlement, that the Cochineal is the produce of such settlement, to be produced to the Society on or before the first Tuesday in February, 1822.

N. B. The premiums from No. 223 to 227 inclusive, are all extended two years farther on similar conditions.

BRITISH MARBLES.

THE SOCIETY considering that it would be beneficial to the Commerce of the United Kingdom to bring the British Marbles into general use, and that the most effectual method of accomplishing their object would be, *for the present*, to make them more generally known in the Capital, have come to the following Resolution:

Resolved, That specimens of British

Marbles be exposed in the Society's Rooms, in the Adelphi, for the inspection of the public under the following regulations:

1st, That all the specimens be exact to a given size, viz. eight inches high, six inches broad, one thick, and polished on one face.

2nd, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name of the parish where situated, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the Marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future inquiries.

As the exertions of the Society can be generally beneficial only inasmuch as their views are seconded by the public, the Society request, that all proprietors of Marble Quarries will favour them with a specimen of the Marble, worked to the exact size above-mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public. By such arrangements, it is expected, that the interest of the proprietors of the quarries will be promoted, and the use of British Marble much extended. A variety are already exhibited in the Society's Rooms.

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REWARDS BESTOWED BY THE SOCIETY DURING THEIR SESSION WHICH COMMENCED ON THE FIRST WEDNESDAY IN NOVEMBER, 1820, AND CLOSED ON THE SECOND WEDNESDAY IN JUNE, 1821.

IN AGRICULTURE AND RURAL ECONOMY.

1. To C. Fyshe Palmer, Esq. M. P. of Oakingham, Berks, for sowing 216 bushels of Acorns on 240 acres, *the large Silver Medal.*

2. To C. Fyshe Palmer, Esq. M. P. of Oakingham, Berks, for planting 280 acres with 893,420 Forest Trees, *the large Gold Medal.*

3. To C. Fyshe Palmer, Esq. M. P. of Oakingham, Berks, for planting 30,700 Oaks for Timber, *the large Gold Medal.*

4. To Thomas Wilkinson, esq. Fitzroy-square, for sowing 240 bushels of Acorns on 260 acres, *the large Gold Medal.*

5. To Sir W. Templer Pole, Bart. Shute-house, near Axminster, for raising 896,000 Oaks from Acorns, *the small, or Ceres, Gold Medal.*

6. To Henry Potts, Esq. Chester, for planting 194 acres with 528,240 Forest Trees, *the large Silver Medal.*

7. To Edward Dawson, Esq. Aldcliffe-hall, near Lancaster, for embanking 166 acres of marsh land from the Sea, *the large Gold Medal.*

IN POLITE ARTS.

Honorary Class.

1.—Original.

1. To Miss Emily Coppin, Norwich, for an original Oil Painting of Fruit, *the large Gold Medal.*

2. To Miss Barnard, Bury St. Edmund's, for an original Painting of Flowers in Water Colours, *the small, or Isis, Silver Medal.*

3. To Miss Harmer, Sloane-street, for a Chalk Drawing from a Bust, *the large Silver Medal.*

4. To Miss Elizabeth Elford, Bickham, near Plymouth, for an original Water Colour Drawing of Flowers, *the Silver Isis Medal.*

2.—Copies.

5. To Mr. James Watts Peppercorne, South Cottage, Vauxhall, for an Historical Drawing in Pen and Ink, *the large Silver Medal.*

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6. To Mr. R. Hayter Jarvis, Long Acre, for an Historical Drawing in Chalk, *the Silver Palette.*

7. To Mr. Edward Knight, Grand Hotel Chambers, Covent Garden, for a Landscape in Oil, *the Silver Palette.*

8. To Miss Emma Davis, Surrey-square, for a Portrait in Oil, *the small, or Isis, Silver Medal.*

9. To Miss Anne Beaumont, Newman-street, for a Portrait in Oil, *the large Silver Medal.*

10. To Miss Stephens, Dorset-square, a Landscape with Figures, in Oil, *the Silver Palette.*

11. To Miss Emma Maria Smith, Upper Conway-street, Fitzroy-square, for a Landscape in Pen and Ink, *the Silver Palette.*

12. To Miss Myddleton Biddulph, Russel Farm, near Watford, for a Portrait in Chalk, *the large Silver Medal.*

13. To Miss Hartman, York-street, Portman-square, for a Holy Family in Chalk, *the Silver Palette.*

14. To Miss Caroline Walter, Devonshire-place, Portland-place, for a Figure in Chalk, *the Silver Palette.*

Class for Artists and Others.

1.—Original.

15. To Mr. I. Wood, High-street, Whitechapel, for an Historical Painting in Oil, Satan starting from the Touch of the Spear of Ithuriel, *the large Silver Medal.*

16. To Mr. Robert Oliver, South-street, Manchester-square, for a Landscape in Oil, *the small, or Isis, Gold Medal.*

17. To S. Mountjoy Smith, Great Marlborough-street, for a Drawing in Chalk from a Bust, *the Silver Palette.*

18. To Mr. T. S. Engleheart, Bayham-street, Camden Town, for a Chalk Drawing from a Plaster Cast, *the Silver Palette.*

19. To. Mr. W. Watts, High-street, Hampstead, for an Historical Painting in Oil, Ubald and the Sirens, (from Tasso), *the large Gold Medal.*

20. To Mr. W. Fairland, Princes-street, Blackfriars, for a Chalk Drawing from a Bust, *the smaller, or Isis, Silver Medal.*

21. To Mr. S. Nicholson, Liverpool, for a Landscape Composition in Pencil, *the large Silver Medal.*

22. To Miss Rose Emma Drummond, Rathbone-place, for an original Portrait in Crayons, *the small, or Isis, Gold Medal.*

23. To Miss Anne Eggbrecht, Frith-street, Soho, for a Chalk Drawing from a Bust, *the Silver Palette.*

24. To Miss Georgina Huntly, Newman-street, for a Group of Portraits in Water Colours, *the Silver Palette.*

25. To Mr. H. Courtney Slous, Bayham-street, Camden Town, for an Oil Painting of a Boar Hunt, *the small, or Isis, Gold Medal.*

26. To Mr. G. Presbury, John-street, Fitzroy-square, for a Chalk Drawing of the Ilissus, in the Elgin Collection, *the small, or Isis, Silver Medal.*

27. To Mr. Penry Williams, Newman-street, for a Chalk Drawing of the Ilissus, in the Elgin Collection, *the large Silver Medal.*

28. To Mr. J. Eggbrecht, Frith-street, Soho, for a Chalk Drawing from a Bust, *the small, or Isis, Silver Medal.*

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29. To Miss Cotton, Chicheley, near Newport Pagnel, for an Oil Painting of Flowers, *the small, or Isis, Silver Medal.*

2.—Copies.

30. To Mr. F. Woodington, Queen Anne-street, for a drawing of figures in Indian Ink, *the Silver Palette.*

31. To Miss Caroline Vendramini, Brompton-row, for a Drawing in Chalk of an Historical Subject, *the large Silver Medal.*

32. To Miss Is. Murray, Paragon, Kent-road, for a Head in Chalk, *the Silver Palette.*

33. To Mr. I. Scarlet Davis, Southampton-row, for a Head in Pen and Ink, *the Silver Palette.*

34. To Miss Turner, Warren-street, Fitzroy-square, for a Portrait in Indian Ink, *the Silver Palette.*

35. To Miss Jane Drummond, Church-street, Soho, for a Portrait in fixed Crayons, *the large Silver Medal.*

36. To Mr. R. F. Cahusac, Cursitor-street, Chancery-lane, for a Pen and Ink Drawing of Two Dogs, *the Silver Palette.*

37. To Miss Welsh, David-street, Baker-street, for a Painting of Flowers on Velvet, *the large Silver Medal.*

38. To Miss Caroline Hanning Evatt, East Hill, Wandsworth, for a Copy in Oil of West's Tobit, *the small, or Isis, Gold Medal.*

39. To Mr. F. Y. Hurlstone, Great Queen-street, for an Historical Painting in Oil, *the large Silver Medal.*

40. To Miss Charlotte Wroughton, Bedford-street, Bedford-square, for a Portrait in Miniature, *the large Silver Medal.*

41. To Miss Biffin, Strand, for an Historical Miniature, *the large Silver Medal.*

Original Architectural Designs.

The subject, a Building suited to the use of the Society of Arts, &c.

42. To Mr. C. Ward, Store-street, Bedford-square, *the Silver Medallion.*

43. To Mr. Edward Taylor, Salisbury-street, Strand, *the large Silver Medal.*

44. To Mr. George Jackson, Lower-Brook-street, *the small, or Isis, Silver Medal.*

Models.

1.—Original.

45. To Mr. C. S. Smith, Norton-street, Fitzroy-square, for a Group of Two Figures, *the small, or Isis, Gold Medal.*

46. To Mr. T. Smith, Norton-street, Fitzroy-square, for a Single Figure, *the large Silver Medal.*

47. To Mr. T. Carline, Shrewsbury, for a Single Figure, *the small, or Isis, Silver Medal.*

48. To Mr. C. F. Bielefeld, St. Martin's Lane, for a Bust, a Portrait, *the small, or Isis, Silver Medal.*

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49. To Miss Anne Wyon, Vauxhall Walk, for a Composition of Flowers in Wax, *the small, or Isis, Silver Medal.*

2.—Copies.

50. To Mr. J. Preece, Upper Mary-le-bone-street, for a Copy in Plaster of the Laocoon, *the Silver Palette.*

51. To Mr. C. Delatre Theakston, Winchester-street, Pentonville, for a Copy in Plaster of the Laocoon, *the small, or Isis, Silver Medal.*

52. To Mr. Frederic Mace, Queen's-row, Pimlico, for a Bacchanalian Figure, *the large Silver Medal.*

Medal Die Engravings.

53. To Mr. Ben. Wyon, Vauxhall Walk, for a Group of Two Figures, *the small, or Isis, Gold Medal.*

54. To Mr. A. S. Firmin, Strand, for a Head, *the small, or Isis, Silver Medal.*

Etchings and Engravings.

55. To Mr. W. De la Motte, Royal Military College, Bagshot, for an Etching of a Landscape, *the small, or Isis, Silver Medal.*

56. To Mr. James Bromley, Trevor-square, Brompton, for an Etching of a Landscape, *the Silver Palette.*

57. To W. Bromley, Esq. A. R. A., Trevor-square, Brompton, for a finished Historical Engraving, *the large Gold Medal.*

58. To Mr. George Hayter, Wimpole-street, for an original Etching from a Picture by Titian, *the large Silver Medal.*

59. To Mr. J. Bromley, South-street, Chelsea, for an Etching of an Historical Subject, *the large Silver Medal.*

60. To Mr. T. F. Ranson, Judd-place, West, for a finished Engraving of a Portrait, *the small, or Isis, Gold Medal.*

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61. To Mr. George Steart, for Improved Tablets for Drawing on, *the small, or Isis, Silver Medal.*

IN MANUFACTURES.

1. To Mr. W. Salisbury, Brompton, for Matting made of the Typha Latifolia (or Bullrush), *the small, or Ceres, Silver Medal.*

IN CHEMISTRY AND MINERALOGY.

1. To Mr. W. Bishop & Co., Pistyll, near Holywell, for the Discovery of Mill-stone of a superior quality, in Halkin Mountain, Flintshire, *the small, or Isis, Gold Medal.*

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IN MECHANICS.

1. To Mr. N. H. Nicholas, Lieut. R. N. Temple, for a Semaphore, *the large Silver Medal.*

2. To Mr. P. Barlow, Royal Military Academy, Woolwich, for his Instrument to correct the local Variation of a Ship's Compass, *the large Gold Medal.*

3. To Mr. B. Rider, Redcross-court, Borough, for a Machine for Cutting Tips for Hats, *Ten Guineas.*

4. To Mr. C. Brandt, Jermyn-street, for a Spring Crutch for a Pendulum, *the small, or Vulcan, Silver Medal.*

5. To Mr. E. Baker, Whitechapel-road, for a Bullet Mould, *the small, or Vulcan, Silver Medal.*

6. To Jos. Goodwin, Esq. Carlton Palace, for a Spring Cross for Horses, *the small, or Vulcan, Silver Medal.*

7. To Mr. G. Witty, Frances-street, Holloway, for a Fire Escape, *Ten Guineas.*

8. To Henry Earle, Esq. George-street, Hanover-square, for a Bed for Patients under Surgical Treatment, *the large Gold Medal.*

9. To Mr. James Story, Theobald's-road, for a Portable Oven, *the small, or Vulcan, Silver Medal.*

10. To Mr. Jacob Perkins, Fleet-street, for a Method of Ventilating the Holds of Ships, and Warming and Ventilating Apartments, *the large Silver Medal.*

11. To Mr. Jacob Perkins, Fleet-street, for Instruments to ascertain the Trim of a Ship, *the small, or Vulcan, Gold Medal.*

12. To Ben. Rotch, Esq. Furnival's Inn, for an Arcograph, *the small, or Vulcan, Silver Medal.*

13. To Mr. S. Lake, Alfred-place, Bedford-square, for a Double Door Hinge, *the small, or Vulcan, Silver Medal.*

14. To Mr. James Allan, Blewitt's-buildings, for his Method of dividing Circular Arcs, *the large Silver Medal.*

The Thanks of the Society were voted to J. C. Curwen, Esq. M.P. for a Communication on Draining; and to George Reveley, Esq. Queen's-square, Bloomsbury, for a Communication on the Use of Soap instead of Oil in setting Cutting Instruments on a Hone; which were ordered for publication in the next volume of Transactions of the Society.

*** Since the last Distribution, One Hundred and Thirty-nine New Members have been Elected.

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PAPERS

IN

AGRICULTURE.

N° I.

RAISING OAKS FOR TIMBER.

The large GOLD MEDAL *of the Society, the premium offered, was this Session awarded to* CHARLES FYSHE PALMER, *Esq. M. P. for planting* 30,700 OAKS FOR TIMBER. *The following communication has been received on the subject from Mr.* PALMER.

Wokingham,
February 1821.

SIR;

OBSERVING that a premium has been offered to the person who shall have raised, since the year 1816, the greatest number of Oaks, either from young plants or acorns, in order to secure a succession of oak timber in this kingdom, I beg leave to state to your Society, that in the month of February 1816, I planted, on the forest land near Wokingham, not calculated for the purposes of husbandry, 700 oaks, above five feet in

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height, and at the distance of several yards from each other; also 10,000 oaks, which had been three years bedded. That in the month of October 1817, I planted 23,000 oaks, above two feet in height, and standing in lines about five feet apart, the ground having been previously prepared by the instruments described by me in the accompanying communication; and that in February 1818 I planted out 7,000 four years old plants.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. CHARLES FYSHE PALMER.

CERTIFICATE.

WE whose names are hereunto subscribed, do hereby certify that we are well acquainted with the plantations, and that we believe the foregoing statement to be true and correct.

THOMAS MORRES, *Minister.*
J. WEBB.
W. LANE.
JOHN ROBERTS.
EDWARD HORNE.
W. B. TRICKEY.
JOHN CHURCHMAN.
WILLIAM LANE, jun.
EDWARD SMITH.
JOHN BROWN.

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N° II.

RAISING OAKS FOR TIMBER.

The small or CERES GOLD MEDAL *was this Session presented to* SIR WILLIAM TEMPLER POLE, *Bart. of Shute-house, near Axminster, Devon, for having raised* 896,000 *Oaks from acorns.*

A CERTAIN time being fixed by the Society for the reception of claims for the several premiums offered for planting, it would be manifestly unjust towards those claimants who have complied with this condition, to admit as competitors with them, those who, from inadvertence or any other cause, have failed in this respect.

Sir W. Templer Pole was unfortunately in this situation, his first communication not having arrived till three weeks after the appointed time. Under these circumstances, the Committee, to whom the matter was referred, came to the following resolutions, which were adopted by the Society :—

" It is the opinion of this Committee, that Sir W. Templer Pole's claim for raising oaks, though otherwise entitled to the highest premium, cannot receive it, his communication not having been made within the prescribed time; but in consideration of the importance and extent of his plantations, they recommend to the Society to present him with the Gold Ceres Medal.

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"They farther recommend to the Society to instruct the Secretary to write to Sir W. Templer Pole, expressing the high sense the Society entertain of the public spirit which suggested and carried into execution his highly important and valuable plantations; and lamenting that an informality respecting the time of sending in the claim, should have prevented them from awarding to him the highest premium, which they feel to be pre-eminently due to his exertions."

The following communications have been received from Sir W. T. Pole on the subject:

Shute House, near Axminster, Devonshire,
February 19th, 1821.

SIR;

I respectfully offer myself a candidate for the Gold Medal advertized by the Society of Arts, for raising Oaks since 1816.

I beg leave to observe, that three years since, I planted, in the richest garden ground, about 98 bushels of prime acorns, collected from the finest and best-formed oaks in my park, which are the largest in this county; that I thereby found employment for many who were almost starving for want of work, and that I can produce certificates from surveyors and nurserymen, that I have, at the most moderate computation, at the least 500,000 trees in the finest condition, though I should speak within compass, if I stated them at three times that number.

Allow me to beg for the form of the necessary certificate, and to express my hope that you will lay this letter before the Society.

I am, Sir,
&c. &c. &c.
WILLIAM TEMPLER POLE, *Bart.*

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Shute House, near Axminster,
February 21st, 1821.

SIR;

I beg leave to transmit you a certificate of my having planted such a number of oak trees, as I flatter myself will entitle me to the Gold Medal offered by the Society of Arts, a premium I should greatly esteem, and which could not fail to encourage my future exertions.

I am, Sir,
&c. &c. &c.

W. TEMPLER POLE.

CERTIFICATE.

February 21st, 1821.

WE the undersigned do hereby certify, that to the best of our judgment and belief, there are now growing in the nurseries of Sir William Templer Pole, Baronet, in the parish of Shute, and county of Devon, at least 896,000 prime oak trees of nearly three years growth, from acorns; that the trees are in a very thriving state, kept perfectly free from weeds, and fenced in a very secure manner; that he procured every acorn from trees fit for the largest ship timber in his majesty's navy, and that we verily believe Sir William Templer Pole has more oak in his nurseries than any gentleman or nurseryman in the west of England. We also certify, that on an average he has planted out upon his estate annually at least 30,000 forest trees for fifteen years past; that this year he has planted out above 46,000, and that he has above 50,000 trees of sorts ready to go out in 1822.

(Signed) RICHARD PHIPPEN, *Nurseryman and Planter.*
JOHN ROWELL.
SAMUEL SAMPSON.

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N° III.

PLANTING FOREST TREES.

The large GOLD MEDAL *of the Society, the premium offered, was this Session awarded to* CHARLES FYSHE PALMER, *Esq., M. P., of Wokingham, Berks, for planting* 280 *acres with* 893,420 FOREST TREES. *The following communication has been received on the subject from Mr.* PALMER.

SIR; March, 29th, 1820.

ENCOURAGED by the approbation which my former exertions in planting Forest Trees met from your patriotic Society, and ambitious of again meriting the honourable distinction of its notice, I take the liberty of laying before the Society, in addition to the usual certificates, some details of the process I have adopted, for converting what was a barren and unprofitable portion of forest into thriving and valuable plantations.

The two ploughs which I used in 1816 to prepare the forest land for the reception of plants, were so constructed as to require their being worked at the same time; and as the accidental failure in one of the ploughs frequently suspended the labour of both teams, I applied myself during the Sum-

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mer of 1816, to the construction of other implements, by which the labour and expense have been reduced to one-fourth, and I have been enabled to carry on my work as extensively with half the number of horses required in the preceding year.

It had always been my object, as a planter, to remove and clear away the heathy surface of the forest land, and to loosen the ground beneath it to such an extent as would allow the tender fibres of the roots to extend themselves, without obstruction, until the plants attained a size and strength sufficient to force their way into the soil.

For this purpose I constructed a cutter or shaver of a triangular form, two feet in breadth, and armed at the point and sides with the best and hardest materials that Mr. Galloway of Holborn could manufacture. To this instrument I fastened two turn-boards, and the beam and handles of a common plough, and with the power of four horses I have been able to clear off the heathy surface with great ease and expedition, and to leave a clear space of two feet in breadth.

My next object was, to loosen the interior of the ground that had been thus pared and cleared from the incumbrance of heath and of its fibrous tangled roots, and to prepare it for the reception of plants. For this purpose I constructed a very strong plough, without any turn-board; and having lengthened the chief or standard to fifteen inches, I attached a very strong ploughshare, with fins on each side, extending about eight inches, and worked it with six horses, such as are commonly used for agricultural purposes. I have been able to make this instrument penetrate the soil to the depth of fifteen inches, and to proceed in thoroughly loosening the ground at a slow but regular pace; and as a proof that this process was not imperfectly performed, it may be proper for me to state, that all my plants were put into the ground at

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eighteen pence per thousand, the price commonly paid by nurserymen.

This mode of planting, and the construction of the implements which I have used during two successive years, in preparing many hundred acres of waste land, I beg leave to submit to the notice of the Society, and to point out the advantages immediately resulting from them.

The first is, that the ground having been well pulverised in the first instance, the plants, in case of failure, can be replaced with little expense of labour.

Secondly, the young plantations are thus secured in a great degree, from the destructive effects of fire, by which both myself and my neighbours had greatly suffered.

The trees in each line stand at the distance of three feet apart, and the different lines at five feet from each other.

Number of Trees planted on 280 Acres of Forest Land, not calculated to repay the Expense of Tillage, in the Parishes of Wokingham and Finchampstead, Berks.

Scotch Fir	566,400
Norway Spruce	110,000
Larch	68,700
Willow	66,200
Sycamore	48,000
Oak	30,200
Ash	3,200
Birch	700
Chesnut	20
	893,420

CHARLES FYSHE PALMER.

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CERTIFICATES.

March 29th, 1820.

We, the undersigned, do hereby certify the plantations above described to be in a healthy and thriving state.

Thomas Morres, *Minister of Wokingham.*
James Webb,
Edward Horne,
Wm. Lane,
John Churchman—*Inhabitants of the Town and Parish of Wokingham.*

In order to convince the Society that the ground on which my plantations have been made is, notwithstanding the depth or rather the looseness of the soil, wholly unfit for cultivation, I beg leave to inclose a certificate from Mr. Smallpiece, the commissioner for making the inclosure, and another signed by the principal inhabitants of Wokingham. I also subjoin a letter from Mr. Walter, showing the result of an attempt made by him to bring a portion of this forest land under culture.

Guildford, April 28th, 1821.

I hereby certify, that the land planted by Charles Fyshe Palmer, esq. in the parishes of Wokingham and Finchampstead, in the county of Berks, is not fit for cultivation.

B. Smallpiece, *Commissioner for Inclosing the above Parishes.*

SIR; April 22nd, 1821.

We, whose names are hereunto subscribed, beg leave to certify to you, for the information of the Board of the Society of Arts, that the lands which have been lately planted with oak, firs, and other forest trees, by Charles Fyshe Palmer, esq. in the parishes of Wokingham and Finchamptead, were

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late part of the waste lands of Windsor Forest; and with the exception of a few small parcels, are wholly unfit for the purposes of cultivation. By much the greater part is considered not to exceed in value from five to six pounds per acre for the fee simple. One hundred acres, part of which is included in the said plantations, were purchased at auction at something less than five pounds per acre.

JOHN ROBERTS, *of Wokingham, Solicitor.*
EDWARD HORNE,
WM. LANE—*Churchwardens of Wokingham.*
PAUL HOLTON,
THOMAS CREAKER,
P. BROWNE—*Members of the Corporation of Wokingham.*
JOHN CHURCHMAN, *an Inhabitant of Wokingham.*
W. B. TRICKEY, *Town Clerk of Wokingham.*

DEAR SIR; Holyport, May 3, 1821.

I HAVE been favoured with your letter of inquiries relative to my farming the heath-land at Wokingham, purchased under the Inclosure Acts and situate adjoining to that you have planted, and I should have answered them earlier, but have been from home.

You are aware that my purchase consists of 80 acres of land, of about the average quality of the Heath. I selected five acres of the best of my whole quantity, and indeed as good as any of the Heath, if I except narrow slips adjoining the old inclosures, which for time out of mind have been trodden and manured by the cattle going thither for shelter both from heat and cold. These five acres I first trenched 18 inches deep, then plowed and sowed with carrots; the expense

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of trenching, plowing, and sowing, was about 2*l.* 10*s.* per acre, and seed about 2*s.* 6*d.* The whole produce of the five acres might be about ten bushels.

I then chalked the land at an expense of 4*l.* per acre, and planted potatoes, about ten bushels to the acre, the cost of seed and planting amounting to about 1*l.* per acre, the produce of which was brought away in a small cart, probably about 20 bushels, from the five acres. In some few instances the potatoes were as large as an egg, but in general from the size of a walnut to that of a pea; and in many spots, where there was a vein of sand, they had not vegetated at all. I then trenched ten acres more, and limed it, at the expense of 5*l.* per acre, and sowed turnips, but the crop was not worth turning sheep into; and last year I sowed rye, and sold the crop standing at 1*l.* per acre, but grew so weary of my ill success, that I have now planted the whole with seedling larch, which I flatter myself will, by their growth, repay me the money laid out in attempting cultivation.

I do, however, think, notwithstanding the little prospect there may be of cultivating with success a large portion of this heath land, that some spots may be found, and this piece of mine amongst the number, which might yield a return, provided they were so situate as to be well manured and chalked, and trod with cattle; but the money which must necessarily be sunk in the operations, would more than purchase the fee of the land in its improved state, without taking into calculation the cost of erecting buildings, which are indispensable to the improvement of the land to any extent.

I am, Sir,

&c. &c. &c.

H. Walter.

To Charles Fyshe Palmer, esq.

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Reference to the Engravings of the Instruments used by C. F. Palmer, esq. in breaking up Land for Planting Forest Trees, Plate I.

Previous to grubbing up the earth to a considerable depth, the heath and turf were pared off the surface by a plough, the wood-work of which consisted of a beam and handles of the usual construction, shown by dotted lines in the plan or bird's-eye view, fig. 1 (*a a* the handles, *b* the beam), and of two turn-furrows *c c* two feet three inches long, nine inches wide, and two inches thick, the lower edges and fronts cased with iron; the fore part of the beam is supported on two cast-iron wheels, twenty-two inches diameter. The draught of the horses (sometimes four at others six being employed) is applied on the top of the beam immediately over the points or fronts of the turn-furrows. The cutter, fig. 2, is formed of a flat plate of iron *d d*, about three-eighths of an inch thick, having the cutting edges forged separately, and rivetted on it. On the fore-part is fixed an upright cutter, preceding the turn-furrows, shown in the section, fig. 3. The cutter is attached to the wood-work by four screw bolts, one passing through each turn-furrow, and retaining it at *e e*, the two others passing through the beam, and terminating at the lower end in hooks, forming a right angle, as seen in fig. 4, on to which are slipped the two eyes *f f*, and the nuts are then made tight: *g g*, in figs. 1 and 4, represent a piece of wood lying between the turn-furrows, and immediately over the cutters; this piece has two mortises in its under surface to allow the application of the eyes *f f* to the hooks on the screw bolts. The piece *g g* is fastened to the turn-furrows, and is connected to the beam and to the handles by two iron bars; the lower portion of one of them is seen at *h*, fig. 4. This plough was used for paring the heath and turf from the hard grounds; on the lighter soils another

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instrument, not differing materially in the wood-work (except in being generally lighter) was used; affixed to this is a cutter, formed as described in fig. 6, the lateral and anterior edges made cutting, and the whole attached to the wood-work nearly as described in fig. 1. In order to prevent the cutter from sinking too deep into the earth, or becoming clogged with the loose soil, it was preceded by a curved piece of wood, *i*, fig. 5, eleven inches by three inches, attached to a stem passing through a mortise in the beam, by which its depth could be regulated at pleasure. The shaded part in fig. 5 shows how much of the turn-furrows were cased with iron.

After the surface had been pared by one of these instruments, the ground was loosened to a considerable depth by the plough, fig. 7; it consists of a strong beam *k*, and handles *l*, the former six inches square at the lower end, and of a pitching, formed wholly of two-inch stuff, contained in the three pieces *m m m*, and cased with iron, where shaded with diagonal lines. This pitching is preceded by a tuch *n* and coulter *o* of the usual construction, but of large dimensions. On the under side of the pitching is fixed a cutter, fig. 8, formed of a bar two inches by one inch, having two fins rivetted or bolted to one side of it, and one fin to the other, the outer edges of the fins being made cutting, and the inner about a quarter of an inch thick. The strap *p* is merely for the purpose of attaching it to the wood-work. The draught is applied to the iron stud *q*, and the beam of this plough is also supported on two wheels.

The cutters actually used in the operations may be seen in the Repository of the Society.

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N° IV.

PLANTING FOREST TREES.

The large SILVER MEDAL, *the second Premium offered, was this Session awarded to* HENRY POTTS, *Esq. of Chester, for planting* 194 *Acres with* 528,240 *Forest Trees. The following communication has been received on the subject from Mr.* POTTS.

SIR;

I BEG leave to transmit to you an account of a plantation made by me, between the months of October, 1817, and April, 1818, on some mountainous land in the parish of Llanferres, in the county of Denbigh, containing one hundred and ninety acres, which I shall feel obliged by your laying before the Committee of the Society for the encouragement of Arts, Manufactures, and Commerce.

The land in question consists of a ridge of limestone rocks, running nearly north and south, and sloping from the summit towards the east and west. Between the rocks there are large tracts of good red soil, consisting of about one hundred and twelve acres, well adapted for the growth of deciduous forest trees, though, from their elevation, not capable of improvement by the plough. The remainder of the plantation consists of rocky and uneven ground, in which there are, however, interspersed many considerable patches of soil suited for planting, and the crevices and fissures of the rocks appear (judging

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from some plantations in the neighbourhood belonging to me, formed on similar sites) to be also favourable to trees.

This plantation was made by Messrs. Archibald Dickson and Sons, of Hassendean-burn, near Hawick, North Britain. In the more favourable situations, the plants were put down at the distance of four feet from each other, and were of the following descriptions, viz.

One-fourth transplanted Ash and Oak, with an admixture of Beech, Sycamore, and Elms.

One-fourth, one and two year transplanted Scotch Fir.

One-half transplanted Larches of different sizes.

The larger trees were all pitted.

In the more exposed and rocky places, the plants were set at about three feet and a half apart, or as close to each other as the nature of the ground would allow of, and were principally two years old seedling larch and Scotch fir. They were chiefly nicked in. The number of trees planted was—

17,400	Oaks, 9 to 15 inches.
6,100	Planes, 1½ to 2 feet.
4,400	Ditto, 12 to 18 inches.
7,660	Scotch Elms, 12 to 21 inches.
9,000	Beeches, 9 to 15 inches.
20,860	Ashes, 12 to 24 inches.
900	Silver Firs, 7 to 12 inches.
960	Birches, 12 to 18 inches.
960	Spanish Chesnuts, 15 to 21 inches.
38,000	Scotch firs, 2 years old, transplanted.
15,000	Ditto - 1 year - ditto
120,600	Larches, transplanted, 9 to 18 inches.
15,400	Ditto - ditto - 6 to 12 inches.
151,000	Scotch Firs, 2 years seedlings.
120,000	Larches - ditto - ditto.
528,240	

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The seasons have been favourable for the growth of trees since this plantation was made, and the whole appear to be in a very thriving and promising state.

I have taken great care to preserve this plantation from injury by sheep and cattle. On three sides it is protected by stone walls of five and six feet in height, and 314 roods (or rods) in length. On the sides most exposed to trespass of that description, the walls for 212 roods are six feet high, 125 roods of the loftier walls being well plastered on the outside to prevent sheep getting any footing on the projecting stones. Within the walls I have planted good quicksets at 6 inches apart, which have been properly weeded, and are growing well. On the fourth side of the plantation, which adjoins to cultivated lands, it is well protected by good hazle and thorn fences.

I transmit you a certificate from Messrs. A. Dickson and Sons, as to the kinds and numbers of trees planted, and their present appearance, and from my bailiff, confirming their account as to the number of trees furnished by them; also from Thomas Lewis, esq. and the Rev. Ellis Wynne, gentlemen resident in the parish of Llanferres, as to the present state of the plantation and the fences.

In the Spring of 1818, I also planted over four acres of land at Nant Stabal, in the parish of Llanferres, with two years old transplanted larch and Scotch firs, set at about the distance of four or four feet and a half apart. This plantation is inclosed with a stone wall, five feet high, on the most exposed side, and with a quickset hedge, protected by posts and rails, and a three foot wall on the other sides. I also, in the same season, caused the vacancies in several newly-made plantations at Maes y Safn, and other places in the same parish, amounting at least to 20 acres, to be carefully filled up with transplanted oaks, and other forest trees. For

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this purpose, Mr. John Rogers, of Chester, nurseryman, supplied me with 19,600 plants; the remainder were taken out of my own nurseries. These trees have in general succeeded, and are doing well.

Between the month of October, 1818, and April, 1819, I replanted two woods belonging to me, which had been cleared by a fall of timber. One of these woods, called Coed y Felin, is in the parish of Llanferres, and consists of nine acres; some of the old timber having been left for ornament, I think that about six acres were replanted. This wood is well sheltered, and trees of considerable size are now growing upon it. The plants I put down were chiefly oak, beech, sycamore, and larch, two feet high, and planted about four feet asunder. These trees are now growing very well. The other wood, so replanted, is upon a farm called Maes y Groes, in the adjoining parish of Kilken, and county of Flint. It consists of several dingles, containing together 25 acres, well sheltered, and particularly favourable to the growth of oak trees. The most valuable timber having been cut down about six years since, before the farm came into my possession, the fences were much neglected, and cattle suffered to brouse the young shoots rising from the stools of the trees fallen, and no young trees had been planted to replace those that had been cut down. In this state I found it, and immediately proceeded to repair the fences, and to cause the young saplings to be pruned, and the underwood cleared away, so as to allow of the wood's being regularly replanted. This was done with oaks, from two to three feet high, set at the distance of nine feet from each other, and the intervals filled up with larch, sycamore, and beech, of about the same height, at four feet and a half apart, as nurses to the oaks. I calculate that the quantity of land entirely replanted may be about 18 acres. The young trees are very thriving. The

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fences round the two last-mentioned plantations are of hazel, thorn, &c. and are made secure against trespass by cattle.

I send you herewith a certificate from Mr. John Rogers, of Chester, nurseryman, of the number of trees furnished by him to me between the months of November, 1818, and February, 1819; and my bailiff Thomas Ellis's certificate, speaks as to their having been properly planted out, and as to the number of plants taken from my own nursery, and the present condition of the two last-mentioned plantations, and of the fences around them.

Though these two plantations were not made at the same period of the year 1818, as that formed by Messrs. Dickson and Sons, and may not in strictness come within the terms of the Society's offer of a premium for the planting of Waste Lands, nor be considered as entitled to that or any other premium, I trust I shall be excused for having mentioned them. I also take the liberty of adding, that I continue my efforts for the improvement of my property and the face of the country, by covering the unproductive land with timber. I have, in the course of the last year (1820), inclosed and planted about nine acres of a well-sheltered dingle, in Llanferres, with two-year-old transplanted oaks, at the distance of eight feet from each other, with transplanted larches and Scotch firs, intermixed, at the distance of four feet apart, as nurses; and in the years 1819 and 1820, I also planted about 25 acres (being part of a large tract of moorish, and totally unproductive land in the same parish, which had been inclosed with stone walls) with two-year-old seedling Scotch firs and larches, intermixed with a few seedling oaks and alders. Some acres of the land last mentioned had been planted about the year 1817, but the trees had in general failed; which I attribute to the circumstance of the plants used being rather too large, and more particularly to the mode of planting them,

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which was by making pits for the trees. These pits formed receptacles for the water during the winter months, and the roots of the trees rotted. The seedlings planted by me were *nicked* in, and seem likely to succeed.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. HENRY POTTS.

CERTIFICATES.

To the Honourable the Society of Arts, Commerce, and Manufactures, Adelphi, London;

I, Archibald Dickson, the younger, of Hassendeanburn, near Hawick, in the county of Roxburgh, nurseryman, do hereby certify, that in the month of November, 1817, I, together with Archibald Dickson, senior, and James Dickson, my co-partners, contracted with Henry Potts, of the city of Chester, esquire, to plant for him with forest trees, 180 acres of land, in the parish of Llanferres, in the county of Denbigh; 112 acres of which appeared to be well calculated for the growth of deciduous timber, and the remainder chiefly adapted for larch and fir trees. The terms of our engagement were, that on the above-mentioned 112 acres, the trees should be planted at the distance of four feet apart from each other, and on the remainder, at the distance of three feet and a half, or as near as the nature of the ground would admit of. I also certify, that in the month of December, 1817, and in the course of the following Spring, we actually planted for him there—

17,400 Oaks, 9 to 15 inches.
6,100 Planes, 1½ to 2 feet.
4,400 Ditto, 12 to 18 inches.
7,660 Scotch Elms, 12 to 21 inches.

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9,000	Beeches, 9 to 15 inches.
20,860	Ashes, 12 to 24 inches.
900	Silver Firs, 7 to 12 inches.
960	Birches, 12 to 18 inches.
960	Spanish Chesnuts, 12 to 21 inches.
38,000	Scotch Firs, 2 years, transplanted.
15,000	Ditto - 1 year, ditto.
120,600	Larches transplanted, 9 to 18 inches.
15,400	Ditto - - 6 to 12 inches.
151,000	Scotch Firs, 2 years seedlings.
120,000	Larches - 2 years, ditto.
528,240	

And I further certify, that in the month of November, 1820, I viewed the plantation so formed; that the trees appeared to be growing well, and that all vacancies occasioned by death had been properly filled up; and that there are now growing and in a thriving state in the said plantation, at least the number of trees above specified. The walls and other fences round the plantation appear to be well and substantially made. Witness my hand this 15th day of January, 1821. ARCHIBALD DICKSON, jun.

To the Honourable the Society of Arts, Commerce, and Manufactures, Adelphi, London;

I, Thomas Lewis of Glanrafon, in the parish of Llanferres, in the county of Denbigh, esq. do certify, that I am well acquainted with the large plantation in the parish of Llanferres aforesaid, made by Henry Potts, of Chester, esq. in the Spring of the year 1818, consisting of 180 acres of land, or upwards. That it is surrounded on three sides by a stone wall, and on the other side by a sufficient live wood fence, and the trees are completely secured from depredation. That I

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have seen the same several times in the course of the last Autumn, when the plants seemed to be in a very thriving state, and the plantation promises to become very profitable. And I further certify, that I have several times lately viewed two woods belonging to Mr. Potts, called Coed y Felin and Maes y Groes Woods, which have been lately replanted by him. That the young trees which have been set in those woods, as well as in various other plantations belonging to Mr. Potts, at Nant Stabal, Maes y Safn, and elsewhere in the parish of Llanferres, appear to be very thriving, and are properly secured from trespass. Witness my hand, this 19th day of January, 1821.

THOMAS LEWIS.

To the Honourable the Society of Arts, Commerce, and Manufactures, Adelphi, London;

I, the Rev. Ellis Wynne, clerk, rector of the parish of Llanferres, in the county of Denbigh, do certify, that I have several times, in the course of the last Summer, viewed the large plantation in that parish, made by Henry Potts, of Chester, esq. in the year 1818, amounting to about 180 acres, and that the trees therein grow well, and seem likely to form a very thriving plantation. The whole is surrounded by stone walls, or sufficient hedges, and the trees are effectually protected from trespass. Witness my hand, this 17th day of January, 1821.

ELLIS WYNNE, *Rector of the Parish of Llanferres.*

To the Honourable the Society of Arts, Commerce, and Manufactures, Adelphi, London;

I, John Rogers, of the city of Chester, nurseryman, do certify, that in the months of February and March, in the year 1818, I furnished to Henry Potts, of the same city, esq.

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the following forest trees, which were sent to his estate in Llanferres, in the county of Denbigh:

8,700	Scotch Firs.
2,300	Larch.
1,300	Oaks.
500	Sycamore.
2,000	Spruce Firs.
1,500	Beech.
500	Alders.
300	Birch.
2,000	Larch Firs.
500	Ash.
19,600	

And in the month of November, 1818, and January and February, 1819, I also supplied Mr. Potts with the undermentioned Forest Trees, which were also sent to his estate at Llanferres.

12,250	Larch.
6,000	Oaks.
1,050	Beech.
200	Scotch Firs.
200	Sycamore.
50	Ash.
50	Birch.
19,800	

Witness my hand, this 16th day of January, 1821.

JOHN ROGERS.

To the Honourable the Society of Arts, Commerce, and Manufactures, Adelphi, London;

I, Thomas Ellis, of Llanferres, in the county of Denbigh, bailiff or agent to Henry Potts, of the city of Chester, esq.

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do hereby certify, that I was directed by Mr. Potts to look after the workmen employed by Messrs. Dickson and Co. in planting for him a large tract of land in Llanferres, in the Spring of the year 1818. That the plants used on the better part of the land were transplanted deciduous trees, with Scotch fir and larch of the like description intermixed, and they were set at the distance of four feet from each other. That the plants used in the more rocky and exposed places were chiefly two-year-old seedling Scotch fir and larches, and were planted at the distance of from three feet to three feet and a half apart, or as near to each other as the nature of the ground would admit of. And that I verily believe that there were about three thousand trees used for each statute acre of the land planted. That these trees were all healthy and well rooted, and were very well planted. And I do further certify, that all vacancies occasioned by death or accident have been regularly filled up, and the whole plantation is now in a thriving and promising state.

I also certify, that the fences round the said plantation are good and substantial, two sides thereof having been secured by stone walls six feet in height, being in length two hundred and twelve roods, one hundred and twenty-five roods whereof are well plastered on the outside as a protection against sheep. The third side is fenced by a stone wall five feet high, and of the length of one hundred and two roods; and that the fence on the fourth side where the plantation adjoins to the ancient inclosed lands is well made with live wood, and is a sufficient defence against cattle. And that strong quickset plants were set within the walls round the plantation, at the distance of six inches from each other, which have been properly weeded, and are growing well. And I further certify, that between the first week in December, 1817, and the first week of April, 1818, I planted for Mr. Potts four acres of land, at Nant

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Stabal, in Llanferres, with two-year-old transplanted larch and Scotch firs, at the distance of from four to four feet and a half asunder. This plantation is well protected from cattle by a stone wall and a hedge, with posts and rails set on a three-feet wall. I also within the same period filled up the vacancies in several newly-made plantations belonging to Mr. Potts, at Maes y Safn, Nant Stabal, Pant ryd ynog, and elsewhere, in the parish of Llanferres, containing at least twenty acres, by carefully replacing the trees that were dead, with transplanted oaks, beech, and other forest trees, of which I received nineteen thousand six hundred from Mr. John Rogers, of Chester, nurseryman, and the remainder were taken out of Mr. Potts's nursery, at Llanferres. I further certify, that all these plantations are well secured from trespass by cattle, and the trees I planted have in general lived, and are doing well. And I further certify, that in the winter of the year 1818, I received from the said John Rogers, nineteen thousand eight hundred forest trees, which, with twenty-five thousand oaks, beech, larch, and other trees taken out of Mr. Potts's nursery, in Llanferres, were planted by me, or under my direction, between the month of October, 1818, and the month of April, 1819, in two woods belonging to Mr. Potts, the timber in which had been cut down, and the underwood cleared away. That in one of these woods called Coed y Felin, in Llanferres aforesaid, containing nine acres of land; the plants used were oak, ash, elm, beech, and larch; and they were planted about four feet from each other; but as the trees in part of this wood were left standing for ornament, the whole wood was not replanted, but I verily believe that there were at least six acres entirely replanted. That the other wood on Maes y Groes farm, in the parish of Kilken, consisting of about twenty-five acres, the young saplings which had arisen from the stools of oaks fallen about six years since, before the

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farm came into Mr. Potts's possession, were carefully pruned, and the underwood cut away, so as to allow of the land being regularly replanted. In some parts a few old trees remained, with a considerable number of saplings, but I believe that the whole quantity of land replanted by me here was at least eighteen acres. This was done with oaks, two feet high, set at the distance of nine feet from each other, with larches, beech, and sycamore, intermixed as nurses, making the distance from tree to tree four feet and a half. I have frequently gone over these woods, and replaced such trees as have died or been accidentally injured. I have seen them this day, and certify, that the whole are in a thriving state, and likely to make a valuable plantation of oaks. The fences have been carefully attended to, and are all in good condition. I also certify, that in the month of January and February, 1820, I inclosed, by Mr. Potts's direction, nine acres of land in a well-sheltered dingle, near Brynrodin, in the parish of Llanferres, particularly calculated for the growth of oaks, with stone walls and strong quickset hedges and banks, and planted the same with two-year-old transplanted oaks, at the distance of eight feet apart, with larches, Scotch firs, and beech between them, at four feet asunder, and that these trees are all growing remarkably well. Also in the years 1819 and 1820, I planted for Mr. Potts about twenty-five acres of land, near Pant Dû, in Llanferres aforesaid, on a spungy moist bottom, with two-year-old seedling larches and Scotch firs, with a few oaks and alders intermixed. These trees are well protected from cattle by stone walls, and seem likely to succeed. Witness my hand this 15th day of January, 1821.

THOMAS ELLIS.

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N° V.

SOWING ACORNS.

The large GOLD MEDAL, *being the premium offered, was this Session voted to* THOMAS WILKINSON, *Esq., of Fitzroy Square, London, for* SOWING 240 BUSHELS OF ACORNS *on* 260 *Acres. The following communication has been received on the subject from Mr.* WILKINSON.

8, Fitzroy Square,
January 8th, 1821.

SIR;

As a candidate for the Gold Medal offered by the Society of Arts, &c., for sowing acorns, I beg leave to transmit a certificate of my having planted 120 acres of land with acorns, in the months of October, November, and December 1818, agreeably to the conditions of the Society, and shall feel highly flattered should they deem it worthy of the premium.

I purchased the estate, consisting of 2,600 acres, in the Spring of that year, and the part which is planted is chiefly covered with heath, bilberries, and other mountain berries, with some furze, fern, &c.; the whole is very much encumbered with large loose stones peculiar to the neighbourhood, with which the wall, as described in the appendix to the certificate, was built, to inclose part of the land planted, from the Stiperstones-hill, which is considered the highest ground in the county.

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I likewise at the same time planted 140 acres, in addition to the 120, which are not included in the certificate, for the reasons stated in the appendix.

Any further information upon the subject, in addition to the certificate and appendix, which the Society may think necessary, will with pleasure be communicated, by Mr. Samuel Smith, of No. 10, Gray's-inn-square, who has the management of the estate, and under whose direction and immediate inspection the whole was carried into execution.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. THOMAS WILKINSON.

CERTIFICATE.

Gatten,
September 20th, 1820.

WE, the undersigned, do hereby certify, that Thomas Wilkinson, Esq. planted upon his Gatten estate (on the south-east side of the Stiperstones-hill), in the parish of Ratlinghope, and county of Salop, in the months of October, November and December 1818, 120 acres of land with Acorns; that there are now growing upon the said lands considerably more than 300 young oak plants on each acre, which have been effectually preserved in order to raise timber, and are now in a healthy and thriving state (specimens are sent); that the said lands are properly and securely fenced, and are unfit for husbandry. The soil varies considerably, but is chiefly of a loamy texture.

JAS. SMITH, *Coppice Green, near Shifnal;*
WM. JACKSON, *Pulverbatch, near Shrewsbury,*
SAM. SMITH, 10, *Gray's-Inn-Square, London.*

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Appendix to Certificate.

Gatten,
September 20th, 1820.

In addition to the 120 acres of land planted with acorns by Thos. Wilkinson, Esq., upon his Gatten estate (on the south-east side of the Stiperstones-hill), in the parish of Ratling-hope, and county of Salop, in the months of October, November, and December 1818, and for which he is a candidate for the Gold Medal, given by the Society of Arts, &c. he planted 140 acres more, upon the same estate and at the same time, making together 260 acres planted with acorns; but the 140 acres being a good deal covered with underwood of hazle, birch, alder, some oak, &c.: it cannot be certified that there are now growing 300 young oak plants on every acre, as they cannot be seen, except in the bare places where they appear in great plenty; and there can be little doubt that there are many more than that number, as the whole of the land was planted at intervals, of from two feet six inches, to three feet asunder, in the following manner:

The acorns were dibbled in by a company of men, each having a pointed hatchet in his hand to make a hole in the ground with, and a pocket hanging before to carry the acorns in. The men proceeded in regular order, as close as they could conveniently walk, making a hole in an oblique direction at every step, putting an acorn into it, and placing the foot firmly upon it to cover it.

An overseer walked behind the men, to see that they performed their work properly, and at about every 30 yards placed a stick in the ground with a white mark on the top, in the line where the last man went, which served as a guide to the first man in returning, showing him how far was planted; as soon as he (the first man) had passed the stick, on his

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return, the overseer again removed it into the line of the last man.

The men planted, upon an average, about 14 quarts per day each. There were 240 bushels of acorns planted upon the 260 acres of land; the cost of the acorns was 3*s.* 3½*d.* per bushel; planting 3*s.* 8½*d.* per bushel; average cost per acre, including acorns and planting, 6*s.* 5½*d.*; men's wages 20*d.* per day.

To prevent the depredations of vermin, the acorns were moistened with water, and well dried with common sulphur, previous to their being planted.

All the land planted is quite unfit for the purposes of husbandry, being chiefly steep sides of hills, and boggy dingles, covered with heath, &c. and full of large loose stones; it is very well adapted for the growth of oak (being principally of a loamy texture), and both the oak trees and stools growing there before, and the young plants, have a very healthy appearance, and thrive well.

To secure the above lands from trespass, stone walls, 5 feet 6 inches high, have been built to the extent of 1,900 yards, and strong fences with deep ditches made, 9,000 yards in length. The wet and boggy places have been drained by open ditches, to the extent of 14,000 yards.

JAMES SMITH, *Coppice Green, Shifnal.*
SAM. SMITH, 10 *Gray's-Inn-Square, London.*

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N° VI.

SOWING ACORNS.

The large SILVER MEDAL *of the Society, being the second premium offered, was this Session awarded to* CHARLES FYSHE PALMER, *Esq. M. P., of Wokingham, Berks, for* SOWING 216 BUSHELS OF ACORNS *on* 240 *Acres. The following communication has been received on the subject from Mr.* PALMER.

Wokingham,
February, 1821.

SIR;

As a premium has been offered by the Society for the Encouragement of Arts, Manufactures, and Commerce, "for having set between the first of October 1818, and the first of April 1819, the greatest quantity of land with acorns," &c. &c., "in order to raise timber," I beg leave to state, that in the Autumn 1818, I collected 216 bushels of acorns (each bushel containing about 8,000 acorns), which were planted in the months of October, November, and December of that year, and in the Spring of the next year, in the following manner, on forest land, not capable of husbandry:

The ground was, in the first place, loosened to a proper depth by means of instruments of my own invention, and which are particularly described in my communication on

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planting forest trees, which accompanies this paper. The acorns were then set a yard asunder, in lines, partly by means of the dibble, and partly by means of the spade, which latter mode I am on the whole disposed to prefer, as by thus raising the ground sufficiently to insert the seed, it becomes imbedded in a soft porous medium, peculiarly favourable to the progress of the root in its most tender state.

The great extent of the plantation obliged me to employ two men with guns, and several boys stationed in different places, in order to frighten away the rooks and other birds, the expense of which, when continued through the Winter and Spring, added to other sufficiently obvious reasons, induces me to recommend the planting of acorns in the spring only, as at that season the attention of the rooks will be divided between the farmer and planter, and as at all events the necessity of guarding the land from these depredators, will not exist during more than two months. The plants have come up in vast abundance, are healthy and thriving, and if properly thinned from time to time, will probably become fine timber, notwithstanding the incorrigible barrenness of the soil as regards agricultural produce.

I find no difficulty in preserving acorns through the Winter, by mixing them with dry sand and cinder dust, and spreading them about eight or ten inches deep on a dry floor: during the severity of the frost I cover them with straw, or any other long litter.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. CHARLES FYSHE PALMER.

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CERTIFICATE.

We whose names are hereunto subscribed, do hereby certify, that we are well acquainted with the plantations in question, and that we believe the foregoing statement to be true and exact, and that there are not fewer than 300 young oaks on each acre planted.

Thos. Morres, *Minister.*
J. Webb.
W. Lane.
John Roberts.
E. Horne.
J. B. Trickey.
John Churchman.
E. Smith.
J. Brown.

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N° VII.

EMBANKING LAND FROM THE SEA.

The large GOLD MEDAL, *the premium offered, was this Session presented to* EDWARD DAWSON, *Esq. of Aldcliffe Hall, near Lancaster, for* EMBANKING 166 ACRES OF MARSH LAND FROM THE SEA. *The following communication has been received from the candidate on the subject.*

Aldcliffe Hall, near Lancaster,
November 10th, 1820.

SIR;

I BEG leave to present a claim to the Society for the Encouragement of Arts, &c., for the premium offered in No. 34 of their list of rewards published this year. I transmit the certificates required by the Society, and hope they will be deemed satisfactory.

The inclosure, the consideration of which I have the honour to submit to the Committee, consists of 166 acres, 3 roods, 8 perches of land, known by the name of Aldcliffe Marsh, about two miles distant from the mouth of the river Lune, and one mile from Lancaster. It was, with the exception of about three acres, swarded over, and has heretofore been attached as a sheep pasture to the different farms on the manor of Aldcliffe; it was estimated at a low rent, as it was in a great measure overflown by the spring tides, and being intersected by a deep pool, the sheep were frequently surrounded by the water, and consequently lost.

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My first operation was, to convey the land waters from this pool into the Lune, which was done by opening for them a new channel through part of the old inclosures, from nine to twelve feet deep, and 246 yards in length. This cut was walled and covered with stone, and terminates with a hewn culvert of the same material, four yards in length, and two feet square.

On the 8th of May last, the embankment was commenced. It runs parallel with the Lune, which is in that part about a mile and a half in breadth at high water. The highest tides are with a south-west wind, which causes them to set in with considerable violence. The length of the embankment is 2,010 yards; for the first 200 yards at the north (or higher) end, I satisfied myself with a slope of 5 horizontal to 1 perpendicular; in the next 1,400 yards, the slope is 6 to 1, and where the pool formerly discharged itself, it is for 300 yards 7 to 1; the remainder being on higher ground, is 5 to 1; its height averages about 8 feet 6 inches, the greatest perpendicular height being 14 feet 6 inches; the whole of the inside slope is 2 to 1. It is entirely composed of sand, with the exception of the deep part, which is formed of clay, the sand being there worn away by the violent reflux of the tide. Its contents are as follows:—69,456 cubic yards of sand, covered by 53,078 superficial yards of sods or turf 4 inches thick, employing 3,824 horses, and 5,843 men, supposing it had been completed in one day.

In order to give employment to the poor of this neighbourhood, I contracted with five different persons; the whole was completed in August, many difficulties retarding it, from the unusual quantity of rain during the Summer months. On the 29th of May, a violent storm of wind raised the tide, and swept away 1,800 yards of material, which would have totally discouraged the contractors, who had no property, and could

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not have sustained the loss, had I not reimbursed them. I am thankful to say the high tides in September and October have not made the slightest impression, and the whole of the work carries with it every appearance of stability. I apologize, Sir, for the length of this communication; the desire expressed in the rules of the Society, that a detailed account should be given of works of this kind, must plead my excuse.

I am, Sir,
&c. &c. &c.
EDWARD DAWSON.

The Equinoctial tides in September, were the highest in the last twenty-four years.

CERTIFICATES.

November 10th, 1820.

THIS is to certify, that Edward Dawson of Aldcliffe Hall, has, during the Summer of the present year, effectually inclosed and secured from the overflow of the tide, all that tract of land, near Lancaster, called Aldcliffe Marsh.

R. ATKINSON, *one of His Majesty's Justices of the Peace, for the County Palatine of Lancaster.*

November 10th, 1820.

I DO hereby certify, that Edward Dawson, of Aldcliffe Hall, has, during the Summer of the present year, inclosed and effectually secured from the overflow of the sea, all that tract of land, near Lancaster, known by the name of Aldcliffe Marsh.

THOS. BOWES, *Deputy Lieutenant for the County of Lancaster.*

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N° VIII.

EXPERIMENT ON DRAINING.

The Thanks of the Society were this Session voted to JOHN CHRISTIAN CURWEN, *Esq. M. P. (a Vice-President of the Society) for the following communication, detailing the successful result of an* EXPERIMENT ON DRAINING.

London, January 28th, 1821.

DEAR SIR;

INCLOSED, I have the honour to transmit for the Society a paper on Draining; if it should be considered as worthy of the attention of the Society, I shall be greatly flattered.

I have left the country in great distress, and numbers of poor people out of employment. I hope to have the honour of paying my respects to you soon. I disposed of the rice you sent me into various hands. I have planted the wheat in my own garden.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. J. C. CURWEN.

Workington Hall, January 17th, 1821.

The encouragement given by the Society of Arts, for the improvement of Agriculture, and every useful undertaking, emboldens me to submit to them the details of a work recently executed.

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In the present state of the country, more important service cannot be rendered it, than suggestions for the profitable application of capital to labour.

Draining has universally been allowed to be the first and most essential step towards the permanent improvement of land. Fully as all writers are agreed upon this point, the cost that may profitably be expended in accomplishing this desirable object, is by no means ascertained; nor till a few months ago, should I have ventured to have estimated its advantages, as I feel myself now justified in doing. A recent occurrence brought this point strongly under my observation.

It may appear strange, that after twenty years assiduous attention to Agriculture, I should not have formed a pretty correct estimate of the injury sustained from the want of a proper drainage of spring and surface water on any one crop; but so in truth was the case.

A field of 40 acres on the Schoose farm, was last year cropped with Swedish turnips; the land was winter fallowed, and in the highest state of tillage, so as to admit of the turnips being sown in the latter end of April, previous to the long-continued wet, which proved so destructive to the turnip crop in the North of England: it had 30 tons of good dung per acre. The crop averaged on 38 acres, 32 tons and a quarter per acre, that is, twenty-six of bulbs, and six and a quarter of tops; the produce of two other acres scarcely reached twenty tons. The soil and management was the same throughout. It is a strong clay, by no means applicable to the growth of turnips; but the farm afforded no other soil more proper for the purpose. These two acres had by some means been overlooked, when the rest of the field had been drained. The injury arose partly from springs, and partly from the surface-wet resting upon the land. The value of Swedes in common years, is 10*s.* a ton for the bulbs; in the present year they would have sold at 15*s.*

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The loss, therefore, on 12 ton of bulbs, was eighteen pounds, besides the tops, which at 2*s.* 6*d.* a ton, would have amounted to 1*l.* 10*s.*, making a total of 19*l.* 10*s.*

Seventy-two rods of drains (seven yards to the rod) were immediately cut, the cost of which was 5*s.* a rod, or 18*l.*

Had the drainage been executed previous to putting in the crop, it would have been more than paid for by the produce of the present year.

That good often results out of evil, was never more fully exemplified; and with such a striking instance before me of the advantages resulting from completely freeing the land from water, I was powerfully stimulated to undertake the re-drainage of a field of eighty acres, adjoining the Schoose Farm-buildings, and within less than half a mile of the town of Workington.

I was still further excited by the daily and hourly applications for labour, arising, I fear, from the decreased and decreasing capital of the farmer.

The scale of labour has annually been declining, which cannot but be a matter of deep regret to every friend to the country.

The nation has witnessed scenes of great distress during the years of scarcity; but these bore no comparison to the present times.

The hope of the privations being temporary, gave courage to bear up against them: but now the future has nothing to invigorate exertion, or inspire fortitude. Numbers are daily forced into the ranks of pauperism against their will. Industrious habits are destroyed, and with them that providence and forethought which is the basis of the happiness and respectability of the working classes. In order, not only to continue in employment the usual hands, but to extend it to the employing of others, at a season when the active labours of the year are nearly

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closed, I determined on undertaking the re-drainage of Walriggs, a field of eighty acres, which had been drained about 18 years before, in a manner then considered to be effectual.

The main-drains, as far as they go, were well done, and these have been made available in many instances in the present drainage. They all run into the ditches which surround the whole, from which there is a considerable fall on every side of the field. The collateral drains were only twenty inches deep, set with three stones, in the form of a triangle, having about eight inches of cover upon the top. A drain of 20 inches was then thought to be sufficient, and all that was aimed at, was to cut off the springs, no regard being paid to carry off the rain-water, which is so injurious to clay land.

Subsequent experience has shown that, in most instances, the stratum which holds the water is at so great a depth, as to be below the bottom of such shallow drains; that to do the work effectually, the drain must reach the stratum where the wet rests.

The importance of deep ploughing was not heretofor known, or provided for.

Five years ago this field was deep ploughed; it had been foreseen, that in many instances the plough was likely to come in contact with the head of the drains: this did happen, and the consequence has been to render the land as wet, or nearly so, as it was before any thing was done to it.

Fifty out of the eighty acres were greatly injured by water. The annexed plan will point out the manner in which the work has been executed. It was commenced in November, and was finished the second week in January.

The cutting was lett, as it requires practice to keep the drain the exact width. Bad hands are apt to increase the dimensions, and thereby greatly augment the expense of filling,

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which is the expensive part of draining. Gathering and getting stones was done by the day, and employed a number of women and children, besides the persons occupied in the quarries, which were fortunately near at hand. The depth of the drains is from 3½ feet to four feet; the breadth, twenty inches at the top and twelve inches at the bottom. The drains have a cavity at the bottom of six inches, being set with two side stones, and a cover, and then filled with stones to the top, the six inches next the top being filled with small stones, that in case the plough should strike into them, no injury is done to the drain. The drains are thus filled to within ten inches of the surface. It required a solid yard of stone to fill a rod of seven yards; in weight above two tons.

To furnish such an enormous quantity of stones as eight hundred and fifty-nine rods required, was an undertaking of no small difficulty, and could not have been executed in the time, had not other substitutes been found. In coal countries there are strata known by the name of sill or schistus, and rattler, which is a mixture of coal and schistus. Sill is a substance that will not bear exposure to the atmosphere, but rattler does not fall, and is very light in comparison to its bulk.

Recourse was had to these substances, and many hundred cart-loads of both were collected from the coal-banks; the remainder was gathered from the ground, and obtained from the quarries.

	s.	d.	
The cutting, filling, and setting was	1	3	a Rod
Collecting stones, supposing two gathered to each rod	0	8	
Two Carts from the quarries	1	0	
Leading	2	0	
Cutting the drains by the plough ...	0	1	
	5	0	

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The distance the sill and rattler had to be led, so increased the cost of cartage, as to make their cost equal to that of stones.

	l.	s.	d.
Cutting and filling 859 rods of 7 yards, at 1*s.* 3*d.*	53	13	9
3,436 cart-loads of stones for filling, at 10*d.* a cart	143	3	4
Carting the above, at 6*d.*	85	18	0
Filling, at 1*d.*	14	10	6
	297	5	7

Fifty acres of the field have been benefitted by this drainage. The general quality of land deciding the value at which it would be estimated to let, it was considered as worth 40 shillings an acre; from its locality, I conceive I am within bounds, when I rate it as worth from 50 to 55 shillings. The expenditure of two hundred and ninety-seven pounds, has added sixty pounds to the value of the field, which is obtained at five years purchase, or a little less for interest. It is to be observed, the horse-work is valued as if it had been hired; the real cost of that part, done at such a season, is not, to a farmer, one-half. My object was to put the cost at the highest point, more strongly to enforce the advantage resulting from the practice, as it thus leaves nothing to object to.

This field had in the last course 30 tons of manure; it is strong clay. First crop, potatoes, product 26 hundred stone per acre: sown with wheat and clover; both these crops were admirable. The oats this last year are calculated to produce 60 Winchester bushels per acre; it is now preparing for green crop again, and to have 50 tons of manure per acre. Admitting the green crop to profit three pounds per acre by the drainage, which is only half what was lost at average prices this year on the Swede crop, this on the 50 acres would be one hun-

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dred and fifty pounds; calculating it to yield three Winchester bushels per acre more of wheat, at 7*s.* per bushel, this would be fifty-two pounds ten shillings and ten-pence per acre; for the clover for two years 50*l.* more, making a probable increase of produce, without any extra expense, of 252*l.* 10*s.* Thus, in a five years course the whole expense will, in all probability, be repaid, and an annual permanent increase of rent, to the amount of 60 per cent, gained.

Wet is more destructive to pasture than it is to grain and green crops; and as pasture is the most material object near to towns, draining, in such situations, is a more profitable improvement than in any other situation, and will consequently justify a greater expense.

When once dry land is well laid down to pasture, the improvement is permanent. If flooded with water, it cannot remain for any length of time in pasture, but must be again brought under tillage. On wet soils, improvement is almost labour in vain—costly at all times, but now ruinous.

Should the Society deem this undertaking as meriting their attention, it will be highly gratifying to me, who owe them many and great obligations.

The ambition of meriting the honour of their rewards, first directed my attention to agriculture, and I trust the result has not altogether been without its advantages to the public.

I am, Sir,

&c. &c. &c.

JOHN CHRISTIAN CURWEN

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PAPERS

IN

POLITE ARTS.

N° I.

DRAWING-PAPER FOR ARTISTS.

The small or ISIS SILVER MEDAL *was this Session voted to Mr.* GEORGE STEART, *of the Montalt Paper-Mills, Coomb Down, near Bath; for his* LINO-STEREO TABLETS, *or* SOLID LINEN TABLETS FOR DRAWING ON, *&c. The following communication has been received from Mr. S. on the subject, and specimens of his Tablets, both plain and tinted, are placed in the Repository of the Society.*

De Montalt Paper Mills, Coomb Down,
near Bath, Feb. 12th, 1819.

SIR;

I BEG you will lay before the Society of Arts, &c. the six dozen Lino-Stereo Tablets inclosed, invented and manufactured by me, for their inspection. If the Society should be pleased to consider my improvements in an article at pre-

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sent in great request worthy their patronage, I shall feel much pleasure in receiving it, and also in communicating any further information if required.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEORGE STEART.

The Tablets are of two sorts, *rough* and *smooth;* the former finished with a grain or tooth, the more effectually to receive the full touch of a pencil, chalk, or crayon, for which kinds of drawing they are principally intended; while the latter have a much more level surface, for painting in water-colours, or for other delicate works.

The Tablets will be sold to the public at the usual prices charged for the *pasted* card boards. I have already manufactured many thousand dozens for that purpose.

The extra-stout Drawing-Papers, or Card-Boards, as they are usually denominated, are always made by pasting several sheets of paper together, in the manner of a common pasteboard, and afterwards bringing them to a smooth face by pressing and rolling. The pasting is a dirty operation, and the occasion of many defects, some of which are fatal to the degree of perfection and nicety required in a good drawing-board; for it often happens that, let the workmen be ever so careful, the boards are contaminated by a portion of the paste being left on the surface in handling the sheets; and although this may at first escape the eye of the Artist, yet it will be discovered, perhaps when too late, in finishing a picture. But a far more serious accident than this frequently occurs, which it is impossible to foresee or avoid; for after the artist may have spent many days and even weeks upon a favourite drawing, having occasion perhaps several times to re-wet a particular part of it, in order to produce a desired effect in the

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finishing, the adhesive qualities of the paste are destroyed, a separation of the sheets takes place, and blisters rise upon the surface, to the ruin of his labours. It has been often remarked, also, that drawings made upon pasted boards, and exposed in rooms where fires are seldom kept, have very soon been spoiled, whilst a print or a drawing on a single sheet of paper in the same situation, has remained quite perfect. This is readily accounted for, from the great tendency of paste to mould or mildew. A fourth great defect, is, that the far greater part of the drawing and writing papers now in use in this country are of a hollow or spongy texture: this arises from their being made of an indiscriminate mixture of linen and cotton, the greater elasticity of this latter preventing its fibres from closely uniting with those of the flax: the consequence is, an irregular surface, and a porous spongy substance, very different from that which an adherence to the good old-fashioned practice of using fine linen rags only in the manufacture of superior papers would produce. Another serious evil is, that some manufacturers having recourse to the aid of chemistry for bleaching or whitening rags of very inferior quality, by means of the oxymuriate of lime, supply a drawing-paper sufficiently fair to the eye, but which, as it retains a part of the muriatic acid, speedily destroys the fine and delicate tints laid upon it.

The Lino-Stereo Tablet is entirely free from these objections, for the following reasons:—1st, It is not composed of several sheets pasted together, but is moulded from the pulp, of any required thickness, in one entire mass; thus the risk of pasting is avoided, and no separation of the component parts can possibly take place, though wetted ever so often. 2dly, Instead of being compounded of linen and cotton, it is wholly and solely manufactured from the best and purest white linen

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rags, most carefully selected; and consequently without the aid of the oxymuriate of lime, or any bleaching process whatever.

De Montalt Mills, Bath,
March 4th, 1820.

SIR;

In compliance with your favour of the 28th ult. I herewith transmit some samples of the grey and other tinted Tablets, manufactured from linen rags, previously dyed in the pulp, which I shall thank you to lay before the Committee of Polite Arts for their inspection. I believe the colours are permanent, having made many experiments to prove the stability of the colouring materials. The whole were manufactured last Summer, and I regret I cannot at present send more samples, from the circumstance of the stock being nearly all disposed of.

I am, Sir,
&c. &c. &c.
George Steart.

In describing the manufacture of the Lino-Stereo Tablet, it may be necessary, in the first place, to point out the requisite materials, or utensils, and then explain their uses, confining myself to the technical phrases employed by manufacturers in Paper Mills, in order to be more clearly understood.

The Utensils.—1. A mould of the required dimensions, similar to those used for making paper, but considerably stronger, and well supported by additional bars underneath, so as to enable it to carry, or bear a considerable weight or pressure on the face of it, without bagging; with a deckle from 1½ to 2 inches in depth, to retain the fluid pulp on the face of the mould, and to regulate the required thickness of the sheet or tablet; 3 or 4 of these deckles, of different depths, will be wanted for thinner or thicker substances.

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2. A second mould or compresser, in every respect like the first, but so much smaller, that it will fall into and fill the deckle upon the face of the first mould.

3. A light press, very similar to a napkin press, large enough to admit the mould and its compresser, which is to be placed in the most convenient station, near the vat; or in lieu of it, a weight suspended by a pulley over the bridge, laid on the vat; but I consider the press most desirable.

4. A set of felts of the very finest manufacture possible to be procured, of the required size, are indispensably necessary.

5. A pair of rolls or cylinders of large dimensions, such as are used by the rollers of fine metals, made either of iron or brass, fitted up with the greatest truth, and highly polished on the surface, must also be provided, exclusive of all the other requisites in a well-conducted paper manufactory.

The Process.—In selecting the raw materials for the manufacture of the Lino-tablets, great care is taken to reserve the *best and purest white linen rags only*, rejecting all muslins, calicoes, and every other article made of *cotton*. The linen rags are then carefully sorted, overlooked, and cleansed, washed, and beaten into pulp in the usual manner practised by paper manufacturers of the first class.

The pulp being ready, and diluted in the vat by the proper proportion of pure water, the workman dipping his first mould into the vat, takes it up filled with pulp to the top of the deckle, and holding it horizontally, and gently shaking it, causes the water to subside, leaving the pulp very evenly set upon the face of the mould; having rested it for a moment or two on the bridge of the vat, the compresser with its face downwards, is now carefully laid upon the sheet or tablet, and both together placed in the small press close at hand, where it is submitted to a very gentle pressure, in order to exclude a great proportion of the water remaining in the sheet;—it is

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then withdrawn, the compresser and the deckle are both taken off, and another workman couches it, by very dexterously turning the mould upside down and pressing it pretty hard with his hands on one of the fine felts previously laid upon a very level pressing plank, by which means the tablet is left on the felt. The mould is then returned to the vatman, who repeats the process as before. The coucher in the mean time lays another felt upon the sheet or tablet just couched, whereon the second sheet is to be laid in the same manner, and so on, till all the felts are occupied, over which another level plank is placed, and the whole drawn away on a small rail-road waggon to the great press, where it undergoes a pretty severe pressure.

The tablets will now be found to have sufficient adhesion to bear handling with care, and are separated from the felts, and placed one upon another, so as to form packs; these packs are to be submitted again to the action of the press, till more water is expelled, then are parted sheet by sheet, pressed and parted again, and this is repeated as often as necessary, taking care to increase the pressure every operation, until the face of the tablets is sufficiently smooth; they are then carefully dried, sized, picked, sorted, &c. carried to the rolling-mill, and several times passed between the polished cylinders, to give them their last finish. The above is the process for the plain or white tablets. In making the tinted tablets, the following additional particulars are to be attended to:—

The rags are cleansed, washed, and beaten into half stuff in the usual way, the water being drained off, the pulp is put into a vat with a solution in water of acetate of alumine, or sulphate of iron, as a mordant or ground to fix the colour, according to the colour intended to be made; the whole is well incorporated, and suffered to remain for half an hour or more, when the colouring tincture, previously prepared, is added; after which,

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the whole being returned to the engine is beaten into fine pulp, and then wrought into tablets.

The dyeing materials I chiefly make use of are Mangrove bark, Quercitron bark, best blue Aleppo galls, sulphate of iron, and acetate of alumine. A due combination of these materials produces a great variety of drabs, greys, sand-colours, &c. and I believe more permanent or fixed, than can be produced by any other means.

The advantages to be obtained by this mode of manufacture over all others, are sufficiently explained in my former letter.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEORGE STEART.

N° II.

ARCOGRAPH.

The small or VULCAN SILVER MEDAL *was this Session voted to* BENJ. ROTCH, *Esq. of Furnival's Inn, for an* ARCOGRAPH. *The Instrument has been placed in the Repository of the Society.*

SIR; March 21, 1821.

I HAVE to beg you will do me the favour to submit the Instrument sent herewith, and which I have called an Arcograph, to the Society of Arts, hoping they will find it worth their consideration.

I am Sir,

&c. &c. &c.

BENJ. ROTCH.

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This instrument resembles in use the cyclographs of Mr. Nicholson and others, being intended for the purpose of describing, on a given chord, circular arcs, the centers of which are beyond the limits of the drawing-board, &c. and which therefore cannot be obtained by means of the compasses. The instruments above alluded to, however, are not capable of indicating the measurement in degrees of the arcs which they describe. This very desirable improvement is effected by the addition of a graduated quadrant, the divisions of which show on inspection the magnitude of the arc contained between the extremities of the chord line; that is, between the points of the block *g g* (Plate I, fig. 9), against which the limbs of the instrument work.

a a, *a a* are the two limbs, made either of wood or metal; to one of these is attached the brass quadrant *b b*, divided into 180 parts; attached to the other limb is an arc *c d e*, rather exceeding a quadrant; at *c* a fiducial edge is formed, and a point is marked at 90 degrees from the extremity of *d*; so that when the point *c* and zero on the graduated quadrant, coincide, the two limbs *a a*, *a a* are in a strait line; on the outer edge of the quadrant are two projections, with steel screws, on which work the nuts *f f*, the shoulders of which clamp the arc *c d e* to the quadrant *b b* in any position. It is evident that when the limbs are placed at an angle of 90 degrees, the point of the intersection, when made to traverse between the blocks *g g*, would describe a semicircle, and if placed in a strait line, the same point would only describe a strait line, or no portion of a circle; therefore the quadrant being formed into 180 divisions, the division marked by the point *c* will always indicate the quantity of the arc drawn by the instrument. The arc *c d e* is jointed near the fiducial edge, for the purpose of turning up out of the way of the blocks when the limbs approach towards a right angle. Fig. 10 is a section of the joint on a larger scale;

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the axis is a tube for receiving the pen or pencil, with a flanch at the lower extremity. On this axis turn the two portions of the joint attached respectively to the limbs of the instrument, and the whole is surmounted by a collar, on the top of which the hollow axis is rivetted, and this rivet binds the whole together, by means of the flanch at the lower extremity of the axis. The blocks *g g* must not be so thick as to prevent the socket or tube which receives the drawing pen or pencil from passing over them.

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PAPER

IN

MANUFACTURES.

MATTING MADE OF THE TYPHA LATIFOLIA.

The small or CERES MEDAL *of the Society was this Session voted to Mr.* WILLIAM SALISBURY, *of Brompton, for* MATTING, *and other articles made of the* TYPHA LATIFOLIA *(greater Cat's-tail). Specimens of the articles are placed in the Repository of the Society.*

THE material of which matting, and the rush-bottoms (as they are called) of chairs, are usually made, is the scirpus lacustris, known in some parts of England by the name bull-rush, and in Durham and Northumberland by that of polecive. It grows naturally in deep slow streams, and is particularly abundant in the neighbourhood of Newport Pagnel, in Buckinghamshire.

The demand for this article, however, in the Newport

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Pagnel manufactories is considerably greater than that district can supply, and in consequence large importations of the scirpus are made from Holland. Hence in time of war the article is often scarce, and at an exorbitant price.

Prior to the Winter of 1817, Mr. Salisbury, induced by a laudable desire of opening new sources of industry to the unemployed poor, attempted, in various ways, to apply the leaves of the typha latifolia (flag, or greater cat's-tail) to the same purposes as the scirpus. For this purpose he was allowed, by the overseers of the parish of St. George's, Hanover-square, to employ some of their paupers in collecting about 2½ tons of the typha from the marshy grounds about Little Chelsea and Clapham, and afterwards in manufacturing a part of it into mats, baskets, hassocks, chair-bottoms, &c.

Samples of these various articles were laid before the Society in December 1817, and it appeared that with equal skill in manipulation equally neat work might be produced from the scirpus and from the typha. It being, however, a matter of considerable importance to ascertain the relative durability of the two articles under similar circumstances of ordinary wear, the following experiment was made:—A piece of the best Dutch matting at 2*s.* 6*d.* a yard, and a similar one of Mr. Salisbury's manufacture were laid down side by side in the Society's premises on the 13th December 1817. Their relative situations were occasionally changed, in order to equalize, as nearly as possible, the wear to which they were exposed, and on 27th March, 1821, they were taken up and examined by the Committee of Manufactures. On minute inspection, they appeared to be about half worn out, and there was no very perceptible difference in the condition of each.

With regard to the relative expense of procuring and preparing the two articles for manufacture, the Society possess no

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very certain data, as the use of the typha was at first set on foot chiefly in order to employ those parish poor who would otherwise have been idle. Two guineas were paid by Mr. S. for liberty to cut as much of the typha as he pleased from about ten acres of swampy land, near Hammersmith. The matting has been sold at from 9*d.* to 15*d.* per yard, and between 1,000 and 1,500 yards have been disposed of during the last three years.

The typha abounds in all marsh ditches and uncultivated swampy ground in every part of the kingdom, whereas the scirpus is found in quantity sufficient for manufacture only in certain districts; hence the former must be much more accessible and cheaper than even the scirpus of home growth; and the Society indulge the hope, that by giving this notice a place in their annual volume, the knowledge and the use of so abundant and cheap a material may be extended throughout the kingdom, and may form a means of domestic employment to the younger members of poor families.

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PAPER

IN

MINERALOGY.

FLINTSHIRE MILL-STONES.

The smaller, or ISIS GOLD MEDAL, *was this Session voted to Mr.* W. BISHOP *and Co. of Nant y Moch, near Holywell, Flintshire, for their Discovery and Introduction to actual Use of a* MILL-STONE *of superior quality, found in Halkin Mountain, Flintshire.*

THE qualities which fit a stone for grinding corn, especially wheat, are hardness, to prevent it as much as possible from wearing down by the constant friction to which it is exposed, a certain degree of tenacity, to prevent the grinding surface from scaling or chipping off, and a cellular structure, in order to increase the quantity of cutting surface, the walls of the cells being at the same time thick enough to resist the strain upon them.

The advantages hence resulting are, that the flour is in no material degree contaminated by the mixture of earthy particles abraded from the stones, the grinding is expeditiously performed, the bran is completely disengaged from the flour, and the flour itself is very little heated by passing through the mill. This latter circumstance is of great importance, it being

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found, by experience, that flour over-heated, or *killed*, as the technical phrase is, will never produce bread so light as that which is ground cool.

In some parts of the valley of the Seine and of the adjoining districts in which the fresh-water limestone occurs, is found a siliceous rock, in detached masses or blocks, of various size, known on the spot and in commerce by the name of *Buhr*. It is a substance intermediate between hornstone and chalcedony, and possesses, in an eminent degree, the qualities which peculiarly fit it for grinding wheat. All the fine flour required for the supply of the metropolis and of the other large towns in this island is prepared by means of millstones of French buhr, a circumstance which, beside rendering us dependant on foreigners for so essential an article, is the occasion in time of war of enormously enhancing the price, and subjecting our millers to great inconvenience.

The northern shore of the Isle of Wight is the only district in this country in which the fresh-water limestone has hitherto been found, but it does not appear to contain any buhr-stone. The entrochital chert or hornstone (vulgarly called *screw-stone)* which occurs interstratified with the mountain limestone in Derbyshire, as it resembles buhr-stone in quality and texture, has occasionally been made trial of for a grinding-stone, but always unsuccessfully on account of its fragility and softness.—*Sec.*

In the year 1816 Mr. Thomas Hooson, of Flint, observed on Halkin mountain a bed of remarkably fine Porcelain clay, which, on exposure to the potters' fires was found to assume a more delicate whiteness than any substance of a similar nature hitherto found in this kingdom; and seeing also other substances which he thought likely to be useful to the potters, he obtained from Earl Grosvenor a lease of all clays, rocks, and stones (except lime-stone) within his lordship's liberties; and subsequently, with a view to an extended trade, formed his

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present partnership with Mr. Richard Fynney, Mr. William Bishop, and Mr. James Whitehead, established under the firm of the "Welsh Company at Nant y Moch, near Holywell," where they have erected works for preparing the clay, which is called "Cambria," for sale, by separating it from a white siliceous sand and rock, with which the bed is found mixed to a depth at present unknown, but which has been proved as deep as 26 yards. The sand, when separated, is used for glass-making; and the white siliceous rock, now called "Rock Cambria," is ground down and used in the composition of China and earthenware, instead of ground flint, or is mixed with it. For this process of grinding, several thousand tons of chert are annually consumed in the Staffordshire potteries, and much is supplied from Halkin mountain. In quarrying this chert, some of it in the state of vesicular entrochital horn-stone was raised, which, when used together with common chert, indicated such a superiority by its expeditious grinding and its little wear, and showed such a proximity in appearance (after having been worked) to the French buhr; that its use for grinding wheat was considered probable; and this led to the first application of the vesicular Halkin rock as a buhr-stone.

Halkin Mountain (called "Alchene" at the Conquest, according to Pennant) is a range of high uncultivated land, in Flintshire, the mineral property of the right honourable Earl Grosvenor. On the inland side it runs parallel to the boundary hills of the vale of Clwyd; and on the north-east stretches from Holywell for about four miles till nearly opposite Northop, in an angle of about twelve degrees with the river Dee, and averages about a mile in breadth. It is composed of mountain limestone, with the usually accompanying rocks, and abounds with large veins containing lead ore, blende, and calamine, with some appearances of copper; it also affords a rock of a whitish

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quartz, well adapted for certain kinds of mill-stones, for which (according to all our old historians) Flintshire has been famous. But these quarries had been neglected for many years, till lately re-opened by the discoverers of the still more valuable buhrs, and promise to regain their celebrity as grey stones for grinding oats, &c.

The buhr-stone itself, or entrochital horn-stone, is found near the middle of the eastern ridge of Halkin mountain, and on the west side of the ridge, into which it penetrates with a dip of about one yard in six. Its present appearance presents a bed of about four yards thick, between two layers of a compact siliceous slaty chert, covered with a shivery siliceous shale. It dips eastwardly, like all the other strata on the mountain, which consist of lime-stone rock and chert. The buhr-stratum is principally of the same quality as the small mill-stone sent herewith, and attested by Dr. Traill (certificate, No. 1); but rotten masses sometimes occur, and blocks are occasionally found of too close a texture for the miller; and some few are quite solid. Still the corallite structure pervades the whole: the entrochites being perfect and entire in some instances, while in the chief parts of the bed the casts alone remain; thus leaving the rock vesicular, and in this respect differing from the nature of the pores in the French buhr, which appear to have been caused by corrosion, their edges being rusty and impure, whereas those in the Halkin buhrs are of pure flint, and exceedingly sharp and hard.

The quarry from which all the buhrs hitherto used have been procured, now presents a fore-breast of forty yards, and is of the same quality and thickness as at first, but has a thicker covering of shale as it dips into the hill. At the distance of a mile to the north-west, a second quarry is now opening, and appears similar in every respect to the former; and from fragments of buhr here and there found, with pieces

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of shale and of chert, half concealed in the mountain turf, traces of the same stratum may be observed from the one quarry to the other. About half a mile to the south-east of the main quarry, in the same chert-formation, the buhr-stone is also seen to crop out; and in the valley at the foot of the ridge, where a thick bed of lime-stone forms the upper stratum, with a sub-stratum of chert, the miners, in their search for lead-ore, have met with the buhr-stone at the depth of 160 yards from the surface.

In order to prove the Halkin buhrs, the discoverers had some made into mill-stones, which they set up in a neighbouring mill in the borough of Flint; some were had by a millwright, and afterwards sent to a mill at Dunham-o'-th'-Hill, mixed with French buhrs; and one large buhr was shaped into a millstone, and put up at a mill at Ysceifiog.

They considered it would require much time to prove the real character of the buhrs, and that it would be useless to endeavour to make sales till this proof could be satisfactorily made, and therefore they took but little trouble in circulating the object of their discovery for nearly two years, when finding that the stones at Flint mill were highly approved, and found to be a substitute for the French buhrs, they turned their attention to the subject.

They were advised to lay specimens of the buhrs before the Society of Arts, &c. immediately, lest they might be anticipated by some other person in their pretensions to the premium offered, and they accordingly ventured to do so, in February 1820 (under the name of Flint Buhrs), but not

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having then had sufficient trial made of them, they were not in possession of certificates sufficiently extensive on which to rest their claims to the notice of the Society.

As, however, they are now able to adduce proofs that the Halkin buhrs are fully equal to the French, and in some cases are declared to be actually superior to them, they trust that the Society, in looking to the national importance of the discovery, will pass over the trouble that was last year so unintentionally occasioned, and again take the matter into their consideration.

They request permission to lay before the Society the accompanying certificates and letters on the subject; and in order to show that they have not been selecting a few, and withholding any less favourable to their hopes, they beg to state the result of every sale made by them up to the end of the last year, and to add a short review of the particular certificate connected with each case, observing at the same time that not one unfavourable or unsatisfactory trial has yet occurred.

Some of the buhrs got on the discovery of the quarry were (as before stated) converted into millstones, and put up about three years ago at Mr. Evans's mill, in the borough of Flint, who certifies that "he used them nearly two years occasionally for wheat, but chiefly as grey-stones, in which they excelled; that at first he used them seldom for wheat, but afterwards more and more frequently, as he found them answer the purpose; and, by way of comparing them with the French stones, he took six measures of wheat, and ground one-half on the Halkin stones, and one-half on the French stones; there was some very slight difference in the flour, which was in favour of the French; but he did not consider it as a fair trial, as the Halkin stones were not at the time properly faced for wheat grinding, and if the French stones had been faced as rough, the flour from them would not have been better than the

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other. Bread was made from the two kinds of flour, but no one could distinguish between the two. He then had the Halkin stones regularly faced and crached as French, and has found them ever since equal to the French stones in every respect whatever."

Others of the buhrs, got about the same time, were used more cautiously by a millwright, who made a large pair of millstones of Halkin and French buhrs, fixed in alternately, and these were set up more than three years ago at the Horn-mills, near Dunham-o'-th'-Hill, in Cheshire. Mr. John Peers, the present tenant of this mill, entered on it nearly three years ago, and he states that "the stones were in a rough state, and required six months to get them to a proper face, when they ground wheat as well as the best French stones, and have ever since continued to do so; that he prefers the Halkin and French stones mixed to those of French buhrs entirely, as they grind faster, and as well, and full as cool as the French; that he uses them for all purposes, and considers them equal in every respect, and superior in some respects to the French buhrs."

A large buhr got about the same time, was sold to Mr. John Edwards, the occupier of a small mill at Ysceifiog, in Flintshire; he states "that from various causes the buhr was not used till about twelve months ago, when he shaped it into a millstone of three feet six inches diameter; that he has no French stones, but used this as a runner over a blue stone for grinding wheat, and found the flour of good colour, and the bran broad and light; that the stone would bear the finest cracking, and continued to improve and harden till he left the mill in November last."

The next sale was to John Dumbell, Esq., of the Mersey Mills, Warrington (said to be the largest establishment in the kingdom, and containing twenty-two pair of millstones),

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and he certifies that "in March 1820, he received a quantity of Halkin buhrs, which he had forthwith made into millstones, and these were so much approved, that in May 1820 he had buhrs for a second pair; that the two pair of Halkin millstones have been regularly at work ever since, and continue to give great satisfaction to the bakers and flour-dealers; that he conceives they are precisely the same kind of stone as the French buhrs, and cut the grain like them, and are like them in respect to oatmeal, in which neither French nor Halkin stones are used to advantage; and he considers the discovery of great national importance." Messrs. Hurstfield and Passand (now the occupiers of some large mills at Lymm, near Warrington, but who were lately foremen to Mr. Dumbell, and have been practical millers nearly thirty years), state "that they made the Halkin stones which were set up at the Mersey Mills, where there are nine pair of French stones at work; that they made an experiment with some wheat, by grinding some on the best French pair, and some on the Halkin stones, in order to compare the flour, in which there was scarcely any perceptible difference, though the preference was given in favour of the Halkin stones by a corn and flour dealer, to whom the samples were shown; that bread was made from each, but no difference could be perceived; that at first they thought the Halkin stones not quite so hard and tough as the French, but they found them continue to improve, and to become as good as French; that they have seen all varieties of millstones, and made all sorts of millstones, but never saw any buhrs to come in competition with the French, except the Halkins, which they are satisfied will answer every purpose."

In corroboration of these statements, a sample of the bran (sifted in its rough state out of the flour), is respectfully submitted to the Society.

In May 1820 a Halkin millstone was sent to Mr. Pratt,

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of Saredon Mill (a large concern near Walsall, in Staffordshire), and set to work in his mill at Dudley. Mr. Pratt has had a very extensive practical experience for more than thirty years, and in October last he wrote that "it had been applied for several weeks in grinding wheat, and that it ground equal to French stones, and better than some of them; but he had it for grinding barley, &c., and was so using it, and found it answer remarkably well for that purpose; that the face and dress keep good, and for a great length of time; and that in the Spring he would have a pair of Halkin stones to grind wheat." Upon application to Mr. Pratt for the result of his further experience, he writes again on the 26th February, that "he gave a just report of the good qualities of our Halkin millstone in October last, and entertains the same opinion to the present day; but that it had been grinding barley, &c ever since, and he never before met with any stones to bear hard grinding so well, and continue the dress so long."

In June 1820, Mr. Stephens, the owner and occupier of a steam mill in Harrington, Liverpool, having a desire to try the Halkin buhrs, obtained a buhr, which he broke into several pieces, and fixed them into different parts of a pair of French buhr millstones, and he certifies, that "they have since worked to a good face, and crack as well as the rest of the stones, and as far as his opinion can be formed by such a circumstance, he considers the Halkins equal to the French buhrs." He states also, "that he has, at the request of the discoverers, taken out one of the pieces of Halkin buhr from his millstones," which they beg to offer to the attention of the Society as a convincing proof of the toughness and hardness they manifest after a few months' wear, being in this respect also like the French buhrs.

In August 1820, a pair of Halkin millstones, of five feet diameter, were sent to Messrs. Pilling and Co.'s large mills, at Mirfield, near Leeds, who have not yet given any written

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report of the stones; but Mr. Goodwin of Liverpool (a mutual friend of Mr. Pilling, and of the proprietors of the quarry), states, that he lately had a conversation on the subject at Mirfield with Mr. Pilling, who stated "that the stones were not quite so uniformly porous as the sample buhr, and had rather chipped in facing; that they mended of this every time they were faced, and were evidently tougher the longer they worked."

[*N. B.* It is intended to send up Mr. Pilling's own report, by way of supplement, as soon as it can be procured.]

In September 1820, a pair of Halkin millstones was put up at the Aughton water-mill, near Ormskirk, Lancashire, occupied by Mr. Richard Rawsthorn, sen. who has been a practical miller all his life, and is 74 years old, and he states, that "they answer better than French, for they grind cool, and make fine flour, cut bran thin and broad, and crack as fine as any French stone."

In September 1820 a Halkin millstone was also put up at a new windmill at Knotty Ash, near Liverpool, and Messrs. Marr, the tenants, declare, that "they laid down a pair of French buhrs, and a short time after laid down a French and Halkin; that the latter work equally well as the French; stand cracking as well, have been dressed four times, and still improve; soften the wheat as well or better than French do, and cut very broad bran, and preserve the colour as well as any French stone."

In October 1820 a pair of Halkin millstones were sent to Messrs. Hudson and Co., of the King's Mills, Leeds. By a letter from them it appears the stones are not yet in use, so that no positive proof can be had of their grinding, but they say "that their millers who have prepared the stones for work (from which they can form a good opinion of their qua-

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lities in comparison with French buhrs), give them a favourable opinion that they are likely to answer."

In November 1820 a pair of Halkin millstones were consigned to Richard Robinson, Esq. of the Phœnix Iron Works, Dublin; but they were delayed for a long while by stress of weather, and have not yet been put to work; Mr. Robinson, however, says, that "they have undergone a very close examination by some of the first millwrights and millers, who all agree that they appear equal to the French buhrs, and in some instances superior," alluding (it is supposed) to the equability of the pores.

In December last, Richard Sankey, Esq., banker in Holywell, Flintshire, and owner of a large windmill there, having a pair of French millstones which did not give entire satisfaction, removed the runner, and put up a Halkin millstone in lieu of it, and he certifies, that "his tenants like the work done by these better than by the other pair of French stones in the mill; that they clean the bran better, that the flour is soft and of good colour, and the stone keeps its face well, and gives satisfaction in all respects."

The discoverers beg permission to declare further (and are ready to do so on their oath if desired), that the several certificates above mentioned have been given voluntarily and gratuitously, and that the several persons giving them have no concern or interest in the quarry; and that up to the end of the last year, no Halkin buhrs or millstones have been disposed of in any instance except those before mentioned; namely,

Mr. Edward Evans, Flint Mill, Flintshire.

Mr. Peers, Horn Mills, Dunham-o'-the-Hill, near Overton, Cheshire.

Mr. John Edwards, Ysceifoig, Flintshire.

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John Dumbell, Esq., Mersey Mills, Warrington, Lancashire.

Mr. Pratt, Saredon Mill, near Walsal, Staffordshire.

Mr. Stephens, Steam Mill, Hill street, Harrington, Liverpool

Messrs. Pilling and Co., Mirfield Mills, near Dewsbury, Yorkshire.

Messrs. Hudson and Co., King's Mills, near Leeds, Yorkshire.

Mr. Rawsthorn, Aughton Water-Mill, near Ormskirk, Lancashire.

Mr. Marr, Knotty Ash Windmill, near Liverpool.

Richard Robinson, Esq., Phœnix Iron Works, Dublin.

Richard Sankey, Esq., Banker, Holywell, Flintshire.

They have therefore offered to the Society all the evidence which it is possible to produce, and trust that when the various testimonials (collected from different sources and from persons who have had no communication with each other, though all agreeing in approbation) shall have been compared, the Society will be pleased to honour the Halkin Buhrs with their sanction.

W. Bishop & Co.

The several samples alluded to in the preceding report are placed in the Repository of the Society.

CERTIFICATES,

From all the persons named in the preceding statement accompanied the communication of Messrs. Bishop and Co.; of which the following, as being the most important, are subjoined:

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N° I.

Liverpool,
March 3rd, 1821.

I HAVE this day examined the small millstone, of Flint buhr-stone, measuring 11½ inches in diameter, which is about to be sent to London for the inspection of the Society of Arts, and hereby certify, that it is a fair specimen of the rock in the quarry on Halkin mountain, which I visited last year; a vast quantity of stone of a quality equally excellent with this specimen, may be procured from Mr. Bishop's quarry on Halkin, in Flintshire.

THOS. STUART TRAILL, M. D.

N° II.

Mirfield Low Mills,
March 7th, 1821.

SIR;

AFTER having tried your Halkin buhr-stones, for a fair and sufficient time, we are now enabled to lay before you a candid and faithful report of their quality; and this we shall endeavour to do, with as much brevity as is consistent with the importance of the subject.

The perfection of grinding consists, in reducing grain to a requisite degree of fineness, with the least pressure; or, in other words, to make the best and the greatest quantity of flour, out of a given quantity of wheat, with the least pressure. But, the mere good quality of a stone cannot effect this; for we must now call in the aid of art. And here it is that the great art of a miller consists, the putting of work into stones, or the obliquity and disposition of the furrows, every thing else compared with this being only trifles. And, indeed, when we consider that an accurate knowledge of this is grounded upon the doctrine of central forces, which constitutes an important branch of the Newtonian philosophy, we

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need not wonder, that so few understand the real principles of corn grinding. We have, however, reasons to believe, that we have considerably improved it.

From these observations it appears, that though the quality of the stones may be equally good, the effects produced will be different, according as the work is scientifically put in or otherwise; but, if the work and velocity of the stones be the same, we can clearly ascertain the quality of them, by the effects produced.

We will now apply these observations to the stones in question. After twice or thrice taking them up, we were afraid that they would not stand the crack well; but this fear was soon dispelled, as we now find that they wear exceedingly little, and that the crack stands as fine as a hair. We now proceeded to ascertain the quality of the bran compared with our French stones, and for this purpose, we sifted the meal from every pair of stones as it came from the mill-eye; the bran thus retained in the sieve, we placed by itself, and by this means we had an opportunity of comparing the whole together. This we have repeated no less than forty times, and the result has always been, obviously from the very first glance, that the bran produced from the Halkin buhrs, was not only cleaner, but of a more uniform cut; and this has not been perceived by millers alone, but by every person that has accidentally come into the mill.

This we think is quite sufficient to prove the superiority of the Halkin buhrs; but, that every possible doubt might be removed, we had recourse to the following experiment:

We selected the best French stones in the mill, made by the late Mr. Gardiner of Liverpool, who was very famous for his knowledge of French buhrs; and, that the experiment might be the more accurate, we did not grind a quarter of wheat on each pair of stones, as it is impossible to part it from the

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wheat that precedes and succeeds with that degree of nicety that is required, without running the stones empty and thereby injuring them very considerably. But we weighed 480 pounds of meal, ground by each pair of stones, from the same wheat, weighing 57 pounds the bushel. These two parcels, after remaining a week, were weighed again, to see if any accession or diminution of weight had taken place; but the weights were precisely the same as before. The two parcels of 480 pounds each were then dressed, and the result was as follows:

Flour from the Halkin Buhrs	390 pounds.
Flour from the French Buhrs	384
Difference in favour of the Halkin Buhrs	6

Now, in this experiment, the velocity and work of the stones being the same, the quality of the buhrs may be as justly inferred from the effects, or quantity of flour produced, as any other cause in philosophy from its effects.

We remain, Sir,

&c. &c. &c.

J. & W. PILLING.

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PAPERS

IN

MECHANICS.

N° I.

MACHINE FOR CUTTING TIPS FOR HATS.

The sum of TEN GUINEAS *was this Session given to Mr.* BENJAMIN RIDER, *of Red-Cross-court, in the borough of Southwark, for a* MACHINE FOR CUTTING TIPS FOR HATS.

THE top of the crown of a hat, unless capable of more resistance than the other parts, would be peculiarly liable, from its exposed situation, to be beaten in and damaged, especially at the edges. In order to give the requisite strength in the cheapest and most effectual manner, the manufacturers are in the habit of fixing on the inside of the hat, beneath the top of the crown, two or more round pieces of stiff paper or pasteboard, which, in the language of the trade, are called *tips.* These tips are generally made by laying the hat-block on a sheet of paper or pasteboard, and by means of a pencil carried round the edge of the block, describing on the paper a circle of the proper size, which is afterwards cut out by a pair of

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scissars. This method possesses the advantage of perfect simplicity, but consumes a considerable quantity of time; and as the tips thus made are never perfectly round, the support which they afford to the hat is unequal.

By Mr. Rider's machine, several tips may be cut at once of any required diameter, and of a truly circular outline. The price charged by the inventor for tips so cut is (exclusive of the cost of the paper or pasteboard) one penny per dozen. Leather for the tops of caps may be cut in the same manner, and the machine may no doubt be applied to various other similar uses.

The following CERTIFICATE was communicated by Messrs. Eveleigh, Hat-manufacturers.

To the Committee of Mechanics, Society of Arts—

Union-street, Southwark,
Second Month, 8th, 1821.

ESTEEMED FRIENDS;

WE have made use of the tips for hats, cut by the machine of Benjamin Rider, and we so highly approve the same, that we are making arrangements to use none other in future.

We are very respectfully,

FRANCIS & SAM. EVELEIGH.

Reference to the Figures of Mr. RIDER'*s Machine for Cutting Circular Tips for Hats, Plate* III, *drawn one-sixth of the real size.*

Fig. 3 shows a side elevation, *p p*, a strong wooden block, to which the iron arm *q* is firmly screwed by three screws,

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r r r; s s, a circular iron plate, let into the block *p p*, about half its thickness, having a circular ring of pewter melted in it, to make a soft surface to receive the point of the knife (shown in fig. 4, and in section fig. 5); *t t*, the screw which presses down the pasteboards to be cut, on the nose of which, a gauge-plate, *v v* (suited to the size of the tips), is hung by the hollow screw nuts, shown separated in fig. 5; *u u*, a tube formed of two semi-cylindrical pieces, or saddles, which carry the handle and square arm *y*, and are fitted by screws, to move easily on the cylindrical part of the screw *t* (shown separated in fig. 6), by which means the knife *w w* is kept steady, and obliged to advance perpendicularly through the pasteboard, while it revolves round the screw *t* as a centre; *x*, the sliding block on the arm *y*, which carries the knife *w*, and fixes it to cut tips of any required diameter, shown also in fig. 7, an ivory scale being let into the arm *y*, to regulate the diameter of the tip; *z*, a clamp (two of which should be used) to hold the pasteboards together, till all the circular tips are cut out of them; fig. 9, a scraper to take the burs off the surface of the pewter; 10 and 11, keys to turn the nuts and screws; fig. 5, 1 the nut, which goes easily over the cylindrical part of the screw *t*, and is kept up by the nut 2, which goes into the nut 1, and screws on to the screw *t*; and the nut 1 having a screw on the outside, screws into the neck of the gauge-plate *v v*, whereby the gauge-plate hangs on the nose of the screw *t*, so as to rise and fall with it); the conical point of the screw *t* comes through the nut 2, and this point enters the answering centre of the gauge-plate *v v*, and (while pressing it down on the pasteboards) secures its being concentric with the screw *t*: there is sufficient shake in the nuts 1 and 2, to enable the plow-knife to keep correctly close to the gauge-plate *v v*, and to cut the tips perfectly clean.

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N° II.

PORTABLE OVEN.

The small or Vulcan SILVER MEDAL *was this Session voted to Mr.* JAMES STORY, *of Theobald's-road, London, for a* PORTABLE OVEN. *The following communication has been received from Mr.* S. *and a model of the Oven is placed in the Repository of the Society.*

15, Theobald's road, late Swallow-street,
May 19th, 1821.

SIR;

PERMIT me the honour of requesting you to be the medium of conveying to the Society for the Encouragement of Arts, Manufactures, and Commerce, my most grateful thanks for the distinguished token they have been pleased to bestow of their approbation of my humble efforts, in the construction of the Portable Stone Oven. I have also to request that you will do me the favour of stating my perfect acquiescence in all those terms which are contained in your letter of the 30th ult. I have the pleasure of inclosing the statement of the advantages attending the use of the oven in question.

I am, Sir,

A. Aikin, Esq.,
Secretary, &c. &c.

&c. &c. &c.

JAMES STORY.

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The common dimensions of my portable stone oven are the following, viz. 2 feet 6 inches wide, 2 feet 3 inches high. It is composed of Reygate firestone, cased with iron. It requires no separate compartment for the fuel, which must be placed in the cavity of the oven, and be renewed from time to time, till the stone is heated white hot internally. This will take place in an hour and a half, and will employ about a peck of coals, the oven being previously cold. If it still remains warm (for it will be a long time in growing quite cold), the consumption of fuel will of course be proportionably less. When the oven is become sufficiently hot, the door of the ash-pit and the chimney are to be closed up, and the bread, &c. to be introduced.

The weight of the oven is 6 cwt., and the price charged for it is 20*l.*

It was used by Captain Parry, on board the Hecla, in the Winter 1819-20, as appears by the annexed

CERTIFICATE.

London,
January 11th, 1821

SIR;

In reply to your letter of the 8th instant, desiring to know my opinion of the portable stone oven, embarked on board the Hecla, on the late expedition to the Polar regions; I have to acquaint you, that it was constantly used during the Winter of 1819-20, upon the main hatchway of the Hecla's lower-deck, answering the purpose of baking the ship's company's bread, and of warming the deck in part during that period. It is, therefore, my intention, should no better mode be offered by the numerous persons now applying for

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that purpose, to use the ovens in question, in the same manner as before, on board the ships now equipping for the Polar seas.

I am, Sir,

&c. &c. &c.

W. PARRY.

Reference to the Engraving of Mr. STORY'*s Oven,*
Plate III.

Fig. 1 shows the oven taken out of the iron case, and the parts separated; *a a* and *b b* are two fire-stones, which are cemented together and form the dome of the oven; in consequence of this arrangement, if one or both of them crack from the heat, the fractures will most probably not coincide, and the part will not fall to pieces; *c c*, the lower part or floor of the oven, having an ash-pit at *d* to admit air to the fuel through the grate *e*, fig. 2; *f f*, the mouth; *h h*, the iron case which holds the stones together, and into which they are cemented; *i*, the door lined with stone; *k*, the door of the ash-pit; *l l*, the iron cover, with a chimney *m*, coinciding with the opening *n*, in the stone *a a*; *o o*, a damper in the chimney *m*.

Fig. 2, a plan of the iron case *h h*, and of the floor *c c*. The parts are drawn to $\frac{1}{12}$ of the real size.

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N° III.

METHOD OF CORRECTING THE LOCAL VARIATION OF A SHIP'S COMPASS.

The large GOLD MEDAL *and a complete Set of the Transactions of the Society were this Session voted to Mr.* PETER BARLOW, *Professor at the Royal Military Academy, Woolwich, for his improved* APPARATUS FOR ASCERTAINING THE LOCAL INFLUENCE OF A SHIP'S GUNS, &c. ON THE COMPASS. *The following communication has been received from the candidate on the subject, and a Model illustrative of his apparatus, is placed in the Repository of the Society.*

Royal Military Academy, Woolwich,
November 13th, 1820.

IN a mercantile nation like Great Britain, every attempt to improve the practice of navigation, and to diminish its dangers, is entitled to the favourable consideration of the public, and when in those attempts an individual has succeeded in developing any new and useful principle, the more that principle is known, the more rapid will be the consequent improvement. As the Society of Arts, &c. is ever ready to sanction with its approbation and to encourage with its re-

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ward every useful invention or discovery, I feel very desirous of submitting to its notice a method which I have proposed for correcting the local attraction of a ship's guns, and other iron on the compass; a subject which has for some years engaged the attention of the most able navigators and philosophers of this country.

That the guns, ballast, and other iron in vessels of any description, and particularly in ships of war, should have an influence in disturbing the natural direction of the compass, seems now so obvious, that we are astonished it did not long ago attract the attention of the many able English navigators, whose names do honour to the country which gave them birth; yet so far was this from being the case, that when the circumstance was first noticed by Mr. Wales, in one of his voyages with captain Cook, neither the one nor the other of these intelligent observers was able to account for the anomaly they had detected. They found that with the ship's head on different points of the compass, the needle pointed in different directions, deviating as much as 5°, 6° or 7°; but the cause of the anomaly remained unaccounted for, till captain Flinders at length discovered it to be caused by the local attraction of the iron of the vessel, and to be dependent as to quantity and direction on the dip of the needle.

The more recent observations of Mr. Bain, who has published a very useful work on the subject,* and of captains Ross and Sabine in their voyage of discovery towards the North, have confirmed, in a great measure, preceding deductions, and have shown the great necessity of devising some method of correction. In Baffin's Bay, the local attraction was so considerable, as to cause a deviation of nearly 50°, according as the observation was made with the ship's head pointing to the

* Bain "On the Variation of the Compass."

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east or west. Hence there no longer remained any doubt, that the law laid down by captain Flinders is, generally speaking, correct, viz. that the quantity of local attraction depends upon the quantity of the dip, and that the effect is also produced in opposite directions, accordingly as the vessel is in the southern or northern hemisphere of the globe; but at the same time these observations demonstrated, that the ratio of this increase or decrease, which he had assumed was entirely erroneous.

At the same time, however, that these observations demonstrated the inadequacy of captain Flinders's rule, they did not answer the purpose of establishing any new rule more accurate. Indeed, every one had deceived himself by assuming the east and west points to be those of greatest attraction; whereas, as will appear in this paper, those points, in certain places of the earth, are actually points of no attraction; up to this time, therefore, every thing was inaccurate and uncertain, both as it related to the determination of the quantity of deviation, at different points of the compass, and at the same points in different parts of the earth.

In this state of the inquiry, I commenced a series of magnetical experiments, in the beginning of the year 1819, and was so fortunate as to discover two important facts, which promise to throw considerable light upon this hitherto mysterious subject. The one is, that in every mass of iron there is a *plane of no attraction*, viz., a plane, in which a compass being placed, *the iron has no effect upon the needle.* This plane passes from the magnetic north point, to the south, and in this latitude inclines to the horizon, at an angle of 19° 24′, being the complement of the dip. The other is, that the attraction of iron on the compass depends wholly on the surface of the former, and is independent of the mass or quantity. I also discovered other laws of action, founded upon

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these two, which are explained in my "Essay on Magnetic Attractions," a copy of which I have done myself the honour of transmitting with this memoir, begging for it the acceptance of the Society of Arts.

The nature and properties of the plane of no attraction, and of the other laws which result from this fundamental fact, will be best illustrated by referring to fig. 1, Plate II. In this figure O is supposed to represent an iron ball and A A A a sphere within its influence, the points S Q N Q′ being in the meridian. The line N S′, contained in the plane S E N W, denotes the natural direction of the dipping needle in these latitudes, its inclination from the horizon being about 70½°. Now, conceiving Q E Q′ W to represent a circle or plane passing through the centre of the ball and perpendicular to the axis N S, it will be the plane of no attraction, which has this remarkable property, that if lines be drawn in it, as, for example, the lines O C, O C′, O C″, and a compass be placed any where in those lines, or in short in any point of the plane Q E Q′ W, it will be uninfluenced by the iron ball, and will preserve its natural magnetic direction. But as soon as the compass is removed out of this plane, the needle is found to deviate from its original bearing, its south end being drawn towards the ball when the compass is placed below the plane Q E Q′ W, and the north end when it is above; in all these cases the quantity of deviation follows a determinate law. Suppose two other planes in the sphere A A A, each passing through the centre of the ball, and each perpendicular to Q E Q′ W, of which let M O S L, M′ O S L′, represent quadrants. Now supposing a compass placed in each of these planes, somewhere in the lines O L, O L′, but equidistant from O, then the tangent of the deviation of the compass in O L will be to that in O L′, as the rectangle of the sine of twice the arc L M, and the cosine of the arc E M, is

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to the rectangle of the sine of twice L′ M′, and the cosine of E M′ (E being the east point of the horizon), so that the deviation being known for any one situation, it may be computed for any whatsoever.

Having established the above laws, by the most satisfactory experiments, I next ascertained the law for different distances, finding it to be very accurately as follows; viz., the tangent of the deviation is inversely proportional to the cube of the distance, the angular position being the same.

And when different iron balls are employed, the tangent of deviation is directly proportional to the cube of their diameters. But what is the most remarkable is, that notwithstanding the above law seems to indicate that the tangents of deviation are as the masses, yet balls and shells, whatever may be the thickness of the latter (provided it be not less than $\frac{1}{20}$ of an inch), having the same external diameter, give the same results.

The power of attraction, therefore, resides wholly on the surface, and the law becomes, *the squares of the tangents of deviation, are directly proportional to the cubes of the surfaces.* Lastly, I ascertained that all those laws which were deduced from experiments on balls and shells, have equally place in iron bodies of the most irregular forms, and ultimately in ships of war carrying the usual equipments of such vessels.

Hitherto I had proceeded on the foundation of experimental results, and had carefully abstained from advancing any thing which might be considered hypothetical; but seeing the beautiful uniformity and simplicity of the laws above stated, I could not refrain from concluding, that the remarkable fact of the plane of no attraction being perpendicular to the direction of the dipping needle, was not accidental or peculiar to these latitudes, but that the same had place in every part of the world; and it was on this ground I proposed the method which I have

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endeavoured to explain for correcting the local attraction of vessels. It is clear, however, that, independent of observations in other parts of the world, this conjecture, however reasonable and probable, could not be received amongst the established principles of magnetism; and I therefore esteem myself highly fortunate in having lately found that Mr. P. Lecount has been carrying on a course of experiments, in some measure similar to my own, on board H. M. S. Conquereur; and by attentively observing the various phenomena presented by iron bodies on the magnet, in his passage from St. Helena to England, he has most satisfactorily demonstrated, the accuracy of my deduction relative to the varying position of the plane of no attraction in different latitudes, but at the same time wholly independent of any thing I had done, and indeed without being aware that such a work as mine had ever been published.*

One serious difficulty, however, still remained; namely, that all these laws had reference to the dip of the needle, which it is perhaps impossible to ascertain at sea, while the vessel is in motion; and I was therefore led to seek for some method by which this difficulty might be avoided, and it is this practical and mechanical principle which I am desirous of explaining to the Society of Arts; not in its original, but in its improved form. Since the iron of the vessel and the compass maintain the same relative situation with respect to each other during the voyage, and since all the action of the iron may be considered, like that of every other attraction, to be reducible to one common centre, or, in the language of mechanics, to "one resultant," it is obvious, that the effect produced by the distributed iron, is the same as that which would take place from a single large globe of iron, of which the centre should

* See Lecount "On the Polarization of Iron."

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coincide with that centre of attraction. And since a small ball of iron at a small distance, will produce precisely the same effect as a larger ball at a distance proportionally greater; if we consider a line to be drawn from the compass to the centre of attraction of the vessel, and if we fix in that line, but nearer to the compass, a small ball or plate of iron, the action of the latter will be the same as that of the former (the distance being properly adjusted); and being so in one situation, it must continue so in all, because the line joining the centre of attraction with the pivot of the needle will be constantly fixed, as regards the vessel itself, at all times and in all parts of the world.

To be a little more particular in my description, let C (fig. 2 Plate II.) represent an azimuth compass in a certain situation in the vessel, viz. one selected for making observations on the sun's amplitude and azimuth,* and let S be the centre of attraction of the iron of the vessel; let also P represent a plate of iron, having its centre in the line joining S and C, which let us suppose to be fixed at such a distance, that its action on the compass may be the same as that of the iron at S; then it is obvious, since the plate, the compass, and the vessel all move together, that it will continue in all directions of the vessel and in all parts of the world, to produce the same effect as the distributed iron, whatever change may take place in the dip, and in the magnetic intensity. This, then, constitutes the principle of my method of correction, viz.

When a vessel has received on board her guns and stores, let her be warped round point by point, to ascertain the quan-

* Formerly azimuth and amplitude observations, were made in any part of the vessel, but since the effect of the local attraction has been known, navigators are acquiring the habit of taking them at a certain fixed place.

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tity of her local attraction,* and let the situation of the plate be determined (by the directions that follow), so as it may produce the same effect as the iron of the ship; and consequently, so that when the plate is applied, the effect may be doubled. This being done, let the plate be laid aside, and when at any time it is desirable to ascertain the effect of the guns, &c. on the compass, let it be applied to its assigned situation, and observe how many degrees, &c. it attracts the needle out of its prior direction, and just so much will the guns have drawn the same from its true magnetic bearing before the experiment. This being ascertained, and the course of the vessel corrected accordingly, the plate is to be removed and laid aside, till some new circumstance renders its application again necessary.

These directions, however, must be considered as only applicable when the plate is attached to the binnacle compass, as I have proposed in my Essay; when it is applied to the azimuth compass (the improvement to which I wish to draw the attention of the Society), the directions are then somewhat different, although the principle is the same.

Before I describe these, I should observe, that having laid the above proposition before the Admiralty, and my communication being by that board submitted to the Secretary of the Board of Longitude; and Sir George Cockburn, Mr. Croker, and some other gentlemen belonging to the Admiralty, having done me the honour to be present at a series of my experiments on the 24 pounder above mentioned, orders were immediately given for trying them on board some of H. M. ships. It was in consequence of my experiments on board H. M. S. Leven, and profiting by the practical and theoretical knowledge of her officers, that I changed the application of the

See Note 1.

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plate, from the binnacle to the azimuth compass, as being more susceptible of nice observation, besides possessing other advantages, not to be obtained in the former case.* The following are the directions which I left with captain Bartholomew and the other officers of that ship, for using the plate:

When an azimuth, or amplitude of the sun, or any other heavenly body, is taken for the purpose of determining the variation, the observation is to be made as usual, and immediately repeated again with the plate attached, and the difference in the two bearings will be the local attraction.

For example: Suppose the first observed bearing to be 67°, and the same with the plate attached 70° 30′; then

° ′		° ′	
70 30		67 0	
67 0		3 30	
3 30	local attraction.	63 30	correct azimuth.

Again: Let the amplitude, by observation, be 13° 30′, but with the plate only 10° 30′; then

° ′		° ′	
13 30		13 30	
10 30		+3 0	
3 0	local attraction.	16 30	true compass amplitude.

At other times, to find the local attraction, take the bearing of the ship's head or of any other part of the vessel by the azimuth compass; then observe the same again with the plate attached,

* See Note 2.

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and the difference will be the local attraction, it being understood that, in all cases, when the first observed bearing is diminished by the plate, the difference is to be added to the first bearing; and when the first angle is increased by the plate, the difference is to be subtracted.

These are all the directions which are necessary for using the plate, and I trust they are such as cannot be misunderstood by any seaman, entitled to be considered as a practical navigator.

Similar experiments were made by order of the Admiralty, on board H. M. S. Conway, captain B. Hall, and the same directions given; but as this vessel is now upon a long and interesting voyage in the southern hemisphere, it may be some considerable time before I hear from her able and scientific commander.

From the Leven I have already received the most satisfactory account, by a letter from Lieut. Mudge (who, with the other officers of that ship, took the greatest interest in the subject), an extract of which I have annexed to this memoir.

It now only remains for me to describe the nature of the plate and the mode of adjustment. As to the plate itself, it consists only of a circular piece of iron, having a hole and socket in its centre, for placing it upon its pin; or it may consist of two thin plates* screwed together, having a thin piece of board between them: this, however, is only for the sake of correcting slight inequalities, and for giving it some thickness without increasing its weight, in order to prevent its being bent by any fall or blow. A plate of twelve inches diameter, and weighing about four or five pounds, is sufficient for correcting the local attraction of any ship in the navy, its distance from the pivot varying from thirteen to sixteen inches, according to the power of attraction in the vessel.

* See Note 3.

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The best method of determining the proper situation of the plate is to proceed as below:

First, warp the vessel round point by point, and on each point take the bearing of an object on shore, while a person on shore, from the same spot, is taking the bearing of the compass on board; by which means it is obvious the local attraction at every point will be ascertained; for, independent of the latter, the bearings at each observation ought to be diametrically opposite, or differing by 180°; and what the difference exceeds or falls short of this, is due to the action of the iron on board.

This being determined, let a log of wood (A B, fig. 4) having no iron about it, be taken on shore, and let holes be bored in it at 8, 9, 10, &c. inches from its top, to receive the brass horizontal rod R, which is to carry the plate; this pin being inserted in one of the holes, and the compass set on the top of the log, place the plate on the pin, at any distance (as shown in the figure); now turn the log about point by point, and by removing the plate from the pin at every observation, ascertain the deviation produced by the iron; then, if these deviations, at every point, be the same as those found to obtain on board, the plate is properly adjusted; but if this should not be the case (as is the most likely to happen), shift the height and distance of the plate, and try the same again, and after a few trials, the exact position will be determined, so that the deviations on board, and on shore, agree with each other.* This being done, measure very accurately the depth of the centre of the plate below the pivot of the compass, and its distance from the vertical passing through the same; then cause a hole to be bored, and a socket to be introduced into one of the legs of the tripod used for the azimuth compass on board, so that when the brass pin is inserted, as shown in fig. 2, the centre of

* See Note 4.

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the plate may be at the same depth below, and distance from the vertical passing through the pivot of the compass, as was determined on shore, and it will be the fixed situation required. The plate and pin are of course both moveable, and are laid aside except at the time of making the observations above described.* It only remains to add, that as it is important that the place of observation in the vessel should be constantly the same, it will be advisable to have three small holes made in the deck for fixing the position of the feet of the tripod.

If, as may sometimes happen, the observations cannot be made from this fixed station, it will be to no purpose employing this plate; and all that can be done will be to repeat the observation again in the proper place the first opportunity.

Extract of a letter from Lieut. MUDGE, *of H. M. S. Leven, to Mr.* BARLOW, *Royal Military Academy.*

H. M. S. Leven,
Teneriffe, Santa Cruz.

DEAR SIR;

I CANNOT resist the pleasure the writing to you affords me, and I trust if you should think my communication rather premature, you will excuse it, and attribute it to the pleasure I derive from your invention carrying me beyond my bounds. I shall state in full detail all the circumstances which relate to your plate and compass,* as I think you will be pleased to hear how admirably it has succeeded in every respect.

I have found in every instance, that, with the assistance

* See Note 5.

† The compass here alluded to, is one made by Messrs. Gilberts 148, Leadenhall street.

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of the plate, the true variations are very closely determined, which is of course a great object. I have a register of the whole, which I shall send on our return.

"In consequence of our finding an extraordinary error in the two compasses by which we steer, occasioned by local attraction, I have made a point of comparing them with your plate and compass on every point we steered, and of registering their difference. In some instances I have found the deviation by the starboard compass 8°, and greatest when the ship's head is south, which appears to arise from the mass or quantity of iron which is abreast of the compass, and perhaps the centre of attraction, when a compass is placed there, may lie in the side abreast; but it matters little, as your plate has, and I make no doubt will always detect the error. I shall relate a circumstance where we detected such an error in one of the compasses, arising from local attraction, that might have been the cause of the ship being wrecked had we been amongst shoals or rocks.

On the 22nd of May, at noon, we were in latitude 41° 46′ N., and long. by chronometer 9° 53′ W.; taking this as our departure, we sailed by the starboard compass S. 46° W. 183 miles; this placed the ship on the 23rd, allowing the variation 21° W. in latitude 38° 58′ N. and longitude 11° 26′ W. Whereas the observations at noon for latitude, and sights in the morning for longitude, gave lat. 38° 39′ N., and long. 10° 58′ W; so great a difference in 24 hours was attributed to a current, till I compared the starboard or steering compass with the one with your plate, when I found no less than 7° error, to be subtracted from the course steered, making the true course S. 17° W. instead of S. 24 W. which had been taken as correct; by allowing the 7° which we found subtractive from the course, our latitude was, by reckoning,

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38° 41′ N., and long. 11° 02′ W. which agree with observation as close as we can ever expect it to do under any circumstances.

Believe me, Sir,
&c. &c. &c.
WM. MUDGE.

Such is the present state of this method for correcting the local attraction of vessels, which, to be generally useful, must be rendered public, and nothing will more facilitate this object, if it should meet the approbation of the Society of Arts, than giving the present memoir a place in one of the volumes of its transactions; and I am in hopes, when the importance of the subject is considered, it will not be deemed unworthy of such a distinction.

PETER BARLOW.

NOTE 1.

THE method of warping a vessel about, under different circumstances, will suggest itself to any practical navigator; at the same time, it may not be improper to describe here the process as it was practised on board his Majesty's ships Leven and Conway, which differs, in some respects, from the method usually followed, namely, that of taking the bearing of a distant fixed object. The objection to the latter is, that the swinging of the vessel will always produce a greater or less parallax, which it is impossible to estimate correctly.

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Extract from a Report to the Admiralty, relative to the Experiments made on board H. M. S. Leven. By PETER BARLOW.

April 19th, 1820.

THE Leven having dropped down to Northfleet on the 15th instant, I went down on the 17th, for the purpose of making a series of observations before the guns should be brought on board; these observations were conducted as below:—

First, finding that there would be great difficulty in warping the vessel round in the tide way of this place, I proposed and it was agreed to proceed in the following manner:

I took on shore an excellent azimuth compass, by Messrs. W. and J. Gilbert, which I had procured for the purpose, as also a theodolite by Schmalcalder. With the azimuth, the bearing of a distant object was taken, and found to be N. 35° 50′ E., and the theodolite was then adjusted to the same reading, viz. 35° 50′ from zero, by means of which the zero of the theodolite was brought to the true magnetic north, and consequently the bearing of any object might now be determined without any farther reference to the needle. It will of course be understood that the theodolite was fixed immediately over the spot where the azimuth compass was first erected.

The latter instrument was now taken on board, for the purpose of the experiments, while Lieut. Mudge remained on shore to take the bearing of the pedestal,* or pillar, on board with the theodolite.

The ship now beginning to swing to the tide, the word was given "look out;" at which signal Lieut. Vidal, at the

* Captain Bartholomew had ordered a pedestal to be erected just before the mizen-mast, as a fixed situation for taking his azimuths during the voyage.

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azimuth compass on board, kept Mr. Mudge, on shore, in the line of the sights, while the latter gentleman kept in the same way, Mr. Vidal in the field of his telescope. Being thus prepared, the word "stop" was given, at which, each registered the bearing of the other at the same instant. These bearings, independent of the local attraction of the vessel, ought to have been diametrically opposite, and consequently the difference between the two readings, was the error due to the attraction of the iron on board.

The first observation being registered, the word "look out" was again given, and then the word "stop," and the same was repeated as often as possible while the vessel was swinging, Lieut. Boldy taking every time the bearing of the ship's head, by the ship's azimuth compass at the capstan. The advantages of this method are, that both bearings, viz. on board, and on shore, are made to depend upon the same compass, and thus the errors arising from the use of different needles are avoided, as are also those arising from the parallax of a distant object while the vessel is swinging, a source of error which must have attended all former observations of this kind.

The only thing actually necessary in this case is a fine free azimuth card and needle: those commonly served out to the navy are so sluggish, that it is impossible (while there is no motion in the vessel) to depend upon their settling within 2°. or 3° of the true magnetic north.*

The experiments above referred to were made before the guns were got on board; but the same were again repeated on the 19th of April, after they had been all shipped. The following are the results of both series of observations:—

* A reference to fig. 3 may render this description a little more intelligible, by supposing V the vessel in the river R R, and T the station of the theodolite on shore.

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Experiments on board H. M. S. LEVEN, *at Northfleet, April 17th and 19th, 1820, by Mr.* BARLOW *and the Officers of the above vessel.*

GUNS NOT ON BOARD.			GUNS ON BOARD.		
No. of Experiments.	Bearing of Ship's Head.	Difference in Bearing or Local Attraction.	No. of Experiments.	Bearing of Ship's Head.	Difference in Bearing or Local Attraction.	Local attraction shown by the Plate.
1	N 77° 0′ W	— 2° 22′	1	N 71° 0′ W	— 2° 51′	—
2	N 68 30 W	— 2 25	2	N 64 0 W	— 2 07	2 20
3	N 57 0 W	— 1 37	3	N 57 0 W	— 1 39	-
4	N 47 0 W	— 1 54	4	N 47 0 W	— 1 45	-
5	N 32 0 W	— 1 12	5	N 31 0 W	— 1 39	1 30
6	N 20 0 W	— 1 20	6	N 24 0 W	— 1 10	1 0
7	N 14 30 W	— 0 12	7	N 15 0 W	— 1 19	-
8	North.	+ 0 15	8	N 6 0 W	— 0 17	0 40
9	N 5 0 E	+ 0 54	9	N 4 0 W	+ 0 8	-
10	N 16 0 E	+ 1 32	10	North.	+ 0 24	0 0
11	N 32 0 E	+ 1 48	11	N 5 0 E	+ 0 11	-
12	N 45 0 E	+ 2 25	12	N 13 0 E	+ 0 29	0 40
13	N 52 0 E	+ 2 26	13	N 23 0 E	+ 0 46	1 0
14	N 67 0 E	+ 3 15	14	N 57 0 E	+ 1 27	1 30
15	N 74 0 E	+ 3 6	15	N 59 0 E	+ 2 32	-
16	N 83 0 E	+ 2 31	16	N 72 0 E	+ 2 23	2 10
17	East.		17	N 80 0 E	+ 2 51	-
18	S 81 15 E	+ 2 34	18	S 86 0 E	+ 2 11	2 30
19	S 75 30 E	+ 2 30	19	S 85 0 E	+ 2 34	2 30

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The rapidity and force of the tide at Northfleet, prevented our warping the vessel about point by point, which is doubtless the best way. This, however, is easily practised in Portsmouth Harbour, where the above experiments were again repeated by the officers of the Leven, and the plate ultimately adjusted to the latter results, which as I am informed by Lieut. Mudge, somewhat exceeded the above.—The following experiments were made according to the latter method, on board H. M. S. Conway by order of the Admiralty.

Experiments on the Local Attraction of H. M. S. CONWAY, *Portsmouth Harbour, July 24th* 1820, *by Captain* BASIL HALL, *and Mr.* BARLOW, *of the Royal Military Academy.*

Dip, 70° 30′ 3.

No. of Mean Observations.	Direction of Ship's Head.	Observed Bearing of the station on Shore, from the Ship, by Capt. Hall on Board.	True bearing of the Station on Shore, from the Ship as observed by Mr. Forster on Shore.	Local Attraction.	No. of Mean Observations.	Direction of Ship's Head.	Observed Bearing of Station on Shore by Captain Hall.	True Bearing observed by Mr. Forster.	Local Attraction.
1	S b E	N97° 0′E	N 95°40′E	+1° 20′	17	SS E	N 97 0′E	N 97°15′E	−0° 15′
2	South.	96 0	94 3	+1 57	18	SE b S	95 50	96 22	−0 32
3*	S b W	95 20	92 57	+2 23	19	S E	94 10	95 16	−1 6
4*	S S W	95 10	92 19	+2 51	20	S E b E	93 20	94 24	−1 4
5*	SW b S	94 8	91 0	+3 8	21	E S E	91 0	92 30	−1 30
6*	S W	94 2	90 47	+3 15	22	E b S	89 30	91 52	−2 22
7*	SW b W	93 35	90 15	+3 20	23	East.	87 50	91 15	−2 25
8	W S W	93 30	88 32	+4 58	24	E b N	85 0	89 5	−4 5
9*	W b S	92 10	87 32	+4 38	25*	E N E	83 20	86 34	−3 14
10	West.	-	-	-	26	N E b N	82 10	85 31	−3 21
11	W b N	88 0	84 25	+3 35	27	N E	82 15	84 58	−2 43
12	W N W	86 35	83 12	+3 23	28	NE b N	83 0	85 13	−2 13
13	NW b W	85 20	82 27	+2 53	29	NN E	85 50	88 4	−2 14
14	N W	83 25	81 46	+1 39	30	N b E	84 40	85 47	−1 7
15*	NW b N	84 17	82 7	+2 10	31*	North.	83 0	83 7	−0 7
16*	NN W	83 35	82 3	+1 32	32*	N b W	82 28	81 38	+0 50

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1. All the numbers in the preceding Table marked thus,* are those in which two or more observations were made at the same point, and the mean of the two taken. In the others, we had not an opportunity of making more than one observation.

2. Where the apparent, or observed easterly bearing *exceeds* the true easterly bearing, the error or local attraction is marked + (plus); and when the former is *less* than the latter, the error is marked — (minus).

3. With the ship's head at west, the object on shore could not be seen.

Note 2.

It may be proper here to offer a few remarks on the advantage which will, I conceive, arise from attaching the plate to the azimuth instead of to the binnacle compass.

In the first place, as there are always two binnacle or steering compasses placed abreast of each other, they must necessarily be situated either very considerably out of the fore and aft line of the vessel, or be placed so near as to influence each other's direction.

For these reasons, these compasses seldom agree with each other; viz. in the latter case, in consequence of their mutual action, and in the former, on account of each being exposed to a different system of local attractions. Therefore, to render the method which I have proposed in my Essay effective, two plates must be employed, viz. one to each compass. Moreover the motion of the vessel renders exact observations on these compasses very difficult, if not impracticable. Whereas, with a good azimuth compass, the nicest obser-

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vation may be made, and the slightest deviations detected; to which we may also add, that the direction of the needle being, with this instrument, determined by observation on a distant object, as, for example, the Sun, no error will arise from a change in the direction of the course during the observation; while in the other case we have no mark of direction but the *lubber-line*, which is, we may say, in nearly a continual state of oscillation, from the corresponding motion of the ship itself.

Note 3.

In my Essay I have described the plate as being *double*, and those which I have sent out in the Leven and Conway are of that kind. But I have since found that a single plate may be very safely employed, provided we give it sufficient thickness.

The double plate was employed by me in consequence of observing, that in very thin sheet iron, certain parts contained a degree of partial magnetism; and by using two plates, and ascertaining their strong and weak points of attraction experimentally, and combining them accordingly, viz. the weak point of one in contact with the strong point of the other, these partial actions were neutralized. But by using iron, weighing about 6 lbs. to the square foot, the double plate may be dispensed with, the partial action in sheets of this thickness producing no anomalous effect upon the needle, at the distance at which they are placed in the experiment.

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Note 4.

In reference to the directions for fixing the plate, so that it may give the same errors as the ship at every point of the compass, it may be proper to observe, that in the trials by which this is effected, it will be sufficient to attend to these deviations at three points only, besides the north and south; for if the deviations caused by the plate, are the same as those given by the vessel at any three points in one semicircle (besides those corresponding to the meridian), they must necessarily be the same at every point. It will, however, be proper to make choice of three points, at some distance from each other, that the change may be rendered the more obvious. I generally use the East, NE. by N., and SE. by S.; for if we take points nearer to the north or south, the deviations are too inconsiderable to render the increase or decrease arising from a change of position sufficiently obvious. It will in course be the same if we use the West, NW. by N., and SW. by S. for this purpose.

After all, however, this is by far the most difficult part of the process for persons wholly unacquainted with magnetical experiments, and the best way in such case, will be to purchase a plate already corrected, that is, a plate whose effect has been experimentally determined for various positions and distances. Then, having warped the vessel about point by point, and determined its local attraction, it will only be necessary to select from the table delivered with the plate, the series of deviation agreeing with those of the vessel, and opposite to that series are placed the proper distance, height, and positions which the plate ought to have, in regard to the compass to which it is to be applied.*

* Plates, with the requisite Tables, may be had of Messrs. W. and J. Gilbert, Mathematical Instrument-makers, 148, Leadenhall-street.

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It is only necessary to observe, that the table alluded to will only answer while the dip of the needle, at the place where the experiments are made on the ship, and at that place where the plate is adjusted, are the same or nearly so. In order to ascertain how far any correction was necessary in this respect for the various British ports, I solicited permission of the Honourable Commissioners of the Navy, to be allowed a small vessel in order to visit our various naval stations and there to ascertain the actual dip of the needle by experiment. This permission was most readily and cordially given by that honourable board, to whom both on this and on other occasions I am highly indebted; and Commissioner Cunningham, of Woolwich yard, having received directions to appoint a vessel; he, in the most handsome manner, though necessarily with some personal inconvenience, appropriated to this service the Thames long-boat, a vessel possessing every accommodation that could conduce to my convenience and comfort.

Thus provided, I visited all our naval establishments in the Channel, and ascertained the dip of the needle at each, as well as at several other prominent points; but I found the difference in the dip so very small as to render any correction for it perfectly unnecessary; consequently, the plate and table alluded to above, will answer for any port in the British Channel. Whether there be any sensible increase of dip in our northern ports, is a question which can only be answered by means similar to those above described, that is, by actual experiment.

The instrument which I employed in making these observations was an excellent dipping-needle, constructed by Mr. Jones, Mathematical Instrument-maker to the Ordnance, who very obligingly favoured me with the loan of it for the above purpose.

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Note 5.

Some readers will perhaps form a better idea of the principles of the method I have endeavoured to describe, by the representation and description of the model which I have the honour of presenting to the Society, and of which figures 5, and 6 are an elevation and plan. T T is a table, in which is fixed an upright spindle S *s*, which passes through the vessel, and about which it may be turned in any direction at pleasure; D is a brass plate fixed on the deck of the vessel, and divided according to the points of the Compass, the North and South points being fore and aft. H is a hand, or index, moveable on the spindle; C is the compass, P the correcting plate, and R the rod by which it is attached to the pedestal of the compass. The dotted line passing obliquely downwards from C is that in which the centre of attraction of all the guns, and of the other articles of iron contained in the model falls, and in this line the centre of attraction of the plate P is also situated, and at such a distance from C that its power on the needle is equal to that of all the other iron at a greater distance in the same time. Now, to illustrate the nature of the correction by the model, turn it about on its pivot, till the compass shows north, that is, till the lubber-line in the brass compass box and the north of the card coincide; the vessel is then in the meridian, and the moveable index on deck must be set also to point north.

Turn now the vessel on its spindle, till the hand is directed to any other point (as, for example, East): then, if there were no attraction from the iron on board, the compass would show East also; but it will be found to point about E. $\frac{1}{2}$ N., which shows the attraction at that point to be about $5\frac{1}{2}$ deg.;

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and in the same way the attraction at any other point may be observed, the plate during such time being removed; and if at any of those points the plate be applied, it will be found to double the quantity of the error.

To illustrate its application in real practice, turn the vessel about (having first adjusted it), till the apparent course by compass, is east, or any other proposed point, without regarding the index on deck; and now, to find the true course, apply the plate, and observe how many degrees, &c. it attracts the needle, which in the model, at east, will be found about half a point, so that the apparent course by compass will be now E. ½ N., the attraction of the plate having drawn the north end forward about 5½ deg. or a half point. The iron of the vessel had therefore done the same before the plate was applied; consequently, the true course was E. ½ S., and by looking to the index on deck, it will be found that this is actually the course shown. The same will be the case at any other point, except that the quantity of attraction will be different, being most at those points towards the east and west, and less as we approach the meridian. In other parts of the world, however, the east and west will be the points of least attraction, and the greatest will be at the N. E., N. W., S. E. and S. W.; but still the plate will always continue to give the same attraction as the vessel, and will therefore in all places furnish a ready method of correction.

The accurate action of a model is seldom to be expected, and less perhaps in magnetical experiments than in any others. I was therefore very agreeably surprised to find how very correctly this model answered all the conditions which I had found to obtain in the largest vessels.

It will be seen in the summary given in Note 1, that the power of attraction, or rather the tangent of the angle of

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deviation, at different distances, is reciprocally as the cube of those distances, and that the tangents of the angles of deviation, are also proportional (directly) as the cube of the like linear dimensions of similar masses; if, therefore (as in the model), the magnitudes of the masses are proportional to the general dimensions, the deviations ought to be analogous, and even equal to those in a vessel at large; and a few experiments on the model will show that this is not merely the case theoretically, but that practically the agreement is much closer than could possibly have been anticipated.

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N° IV.

IMPROVED BULLET-MOULD.

The small or VULCAN SILVER MEDAL *was this Session voted to Mr.* EZEKIEL BAKER, *of Whitechapel-Road, London, for an* IMPROVED MOULD AND NIPPER FOR BULLETS. *The following communication has been received on the subject from Mr.* B., *and the Instrument has been placed in the Repository of the Society.*

24, Whitechapel-road,
Feb. 8, 1821.

SIR;

I TAKE leave to request you will lay before the Society, for the Encouragement of Arts, &c. a new invented Bullet Mould, which, after infinite labour and very considerable expense, I have brought to perfection; and in claiming the merit of the invention, I trust the following explanation of the improvement will be satisfactory to the Society:

First, The mould has a much larger countersink on the top, and of course holds a greater quantity of melted lead, which, as it sinks in the mould, prevents that hollowness which is generally found in balls cast from moulds in the usual way, and consequently renders them far superior.

Secondly, The steel-cutter on the top of the mould is a considerable improvement on the old cutter, as will be instantly seen by cutting off the castable, or neck of a ball,

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with each of the cutters. My invention consists in taking off the castable quite clean at once, and at the same time preserving the globular shape of the ball; consequently, the labour and time which were formerly devoted to nipping and trimming, or filing off the exuberance, are now by this method entirely saved, and the ball at one motion is made quite perfect. The double advantage of cutting the balls true in so expeditious a manner, and rendering the balls themselves more perfect, must be instantly perceptible, and I trust will meet the approbation of the Society, who must be aware of the essential importance of the invention to all fire-arms, but more particularly so to rifle barrels, which require the greatest accuracy.

Thirdly, Against the cutter is placed a small cup to hold the ball, which renders the process of cutting off the neck more easy and expeditious.

Fourthly, Under the mould is placed a solid stud, for the purpose of being screwed in a vice, when opportunity offers, by which the balls will be cut easier, and much faster than when simply held in the hand.

Having thus briefly described the new mould, and explained the advantages of the invention, I have to request you will submit it to the inspection of the Society, as I am most anxious to receive their approval before I offer it to public notice. I will not detain you longer by recapitulating the advantages I should individually have experienced by an earlier discovery, nor the labour and expense which would have been saved by its adoption, but shall be happy to furnish any additional information that may be required by the Society, and have the honour to subscribe myself,

Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. EZEKIEL BAKER.

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Reference to the figures of Mr. BAKER'S *Bullet-Mould and Nippers*, Plate IV.

FIG. 1, the bullet-mould entire; *a a*, the nippers of a curvilinear figure; *b*, a spherical depression, formed in the head of the screw-rivet which connects the two halves of the instrument, and correctly concentric with the axis of the rivet. The nippers and rivet are placed so near to each other, that the globular tool employed to form the depression, at the same time forms a hollow of similar curvature on the face of the nippers. This construction is more obvious in figures 2 and 3, in which the dotted lines represent the ball with its castable; *c* are nippers on the old plan.

Fig. 4 is a lateral view, showing the great width of the countersink through which the lead is poured into the mould, and also the screw-rivet which forms the axis of motion.

Fig. 5 represents the two halves of the instrument detached from each other.

It is obvious, that when the castable is removed by means of the common cutter, which may be considered as a plane acting in the direction of a tangent to the spherical surface of the ball, a portion of the castable will be left behind, thus rendering a greater degree of windage necessary, and, in the same proportion, shortening the range of the ball. This defect appears to be avoided in the use of Mr. Baker's new cutter, which acts in an arc of a circle, of which the middle of the ball itself may be considered as the centre.

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N° V.

IMPROVED SEMAPHORE.

The large SILVER MEDAL *of the Society was this Session voted to* NICOLAS HARRIS NICOLAS, *Esq. of the Inner Temple, for an Improvement on the* VERTICAL SEMAPHORE, *and for his method of adapting a shifting Key to Telegraphic Communications, for the purpose of insuring their Secrecy. A Model of Mr.* N.'*s Semaphore has been placed in the Repository of the Society.*

THE vertical Semaphore of Lieut. Nicolas is represented in the lower part of Plate IV. It consists of a vertical pole, to which are attached four pairs of arms, or wings, placed at equal distances from each other. Each arm, by means of cords, or appropriate machinery, is to be made capable of remaining in a vertical, oblique, or horizontal position, the value of each position or number indicated thereby, being that marked in the engraving. The lower pair of arms shows units, the next above shows tens, the next hundreds, and the

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upper pair thousands. In the three lower pairs only nine changes are required; and these, as is manifest from inspection, require only five positions. Thus, to display figure 1, the right arm is elevated to the position marked 1, and the left arm is dropped behind the mast, so as to become invisible: in a similar manner 2, 3, and 4 are displayed. N°s 5, 6, and 7 require the exhibition of both arms, the left one being in the position 4, and the right one brought into the position 1, 2, or 3, as required. N° 8 requires the exhibition of the left arm alone, and N° 9 requires both arms. The upper pair, by means of six positions, indicates all numbers from one to sixteen, so that a single exhibition of this semaphore will give the entire series from 1 to 16999, being a range amply sufficient for all telegraphic purposes.*

The Shifting Key.

The utility of a secret mode of communicating a message by telegraph, must be so obvious, that it would be needless to point out its advantages.

The idea on which the following method is formed, was suggested by the secret cipher used by Buonaparté; and as that was proved to be efficacious, it is hoped that the arrangement of one on a similar plan, adapted for telegraphic purposes, will not be entirely without utility.

* Although this invention is no doubt original with Lieutenant Nicolas, yet it is but justice to Colonel Macdonald, to observe, that precisely the same principle of indicating units, tens, and hundreds, by separate pairs of arms, on the same mast, is contained in fig. ix. in that officer's Treatise on Telegraphic Communication, published in 1817.

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It is to be remarked, that the figures in any part of the Table may be changed, by placing the lines on sliding pieces of paper, like a perpetual almanack; but it would perhaps be sufficient, if the index line of large figures should alone be moveable. If the others are so, care must be taken, that the same figure is not repeated within any two horizontal lines.

Table.

1 2	1 6	2 7	3 8	4 9	5 *
3 4	1 *	2 6	3 7	4 8	5 9
5 6	1 9	2 *	3 6	4 7	5 8
7 8	1 8	2 9	3 *	4 6	5 7
9 *	1 7	2 8	3 9	4 *	5 6

In using this table, any number may be the key, and can be changed at pleasure.

Suppose the key, for example, to be the day of the month, multiplied by 172, the day the 23rd, and the figures of the Table in regular rotation. The real key will become 3784, and it is to be thus used:

Let the real numbers to be signalized be 6764—5398—22—1048—385—4391. Three being the first figure of the key, refer to that figure in the perpendicular line of index

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figures in the table; then look for the figure six, the first of the message, in the line of small figures parallel to the former, and the figure immediately below the first figure of the message, is to be noted down. The next figure of the key 7, and the next of the real number 7, being referred to in the same manner, the corresponding figure will be found to be five, which is also to be noted down, and so on, till the key is finished, when it is to be begun anew, and continued till the message is concluded. The most simple way of ascertaining the fictitious numbers is the following:

Key	3784	3784	37	8437	843	7843
Real Numbers	6764	5*98	20*	1048*	385*	4391**
Fictitious Numbers, *i. e.* the numbers to be signalized.	2548	9*24	60*	8081*	349*	6351**

It is to be particularly remarked, that as the introduction of the cipher in the table, would be frequently attended with inconvenience, it is altogether omitted. By attending to the following rule, confusion will not only be prevented, but the arrangement will be more complicated to those who might attempt to decipher a communication without possessing the key. Whenever the omission occurs, the real figure is to be placed amongst the fictitious ones; and in deciphering a message, the omission will indicate that the figure signalized is the real one. In the example, the figures so circumstanced are marked thus*.

To decipher a message, the order of reference must be inverted, by looking for the figure 2, the first of the fictitious number, in the line horizontal to the figure 3, the first of the key in the index perpendicular line of figures, and *that* under

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the 2, is to be noted down as the first of the message intended to be conveyed: thus,

Key	3784	3784	37	8437	843	7843
Numbers signalized	2548	9*324	6*0	8*081	3*49	6*3*51
Real Numbers . . .	6764	5*398	2*0	1*048	3*85	4*3*91

I am, Sir,
&c. &c. &c.
NICOLAS HARRIS NICOLAS.

Inner Temple, Feb. 26, 1821.

N° VI.

SPRING CRUTCH FOR PENDULUMS.

The smaller or Vulcan SILVER MEDAL *was this Session voted to Mr.* C. BRANDT, *of Jermyn-street, London, for an* ADJUSTING CRUTCH FOR CLOCKS. *The following communication has been received from Mr.* B. *on the subject, and a Model of his Invention is placed in the Repository of the Society.*

62, Jermyn-street, St. James's,
Feb. 8, 1821.

SIR;

I SHALL feel obliged if you will have the goodness to lay before the Society for the Encouragement of Arts, Manufactures and Commerce, of which I have the honour to be a member, a model of an adjusting crutch for clocks; it is my invention, and the simple, easy, and correct manner by which you may set

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a clock in beat, has flattered me that it would be worth the Society's consideration. The difficulty of putting common clocks in beat, is occasioned by the necessity of bending the crutch, which can never be correctly done, whereas this is done by one simple adjusting screw.

I am, Sir,

&c. &c. &c.

CHARLES BRANDT.

Reference to the Figures of Mr. BRANDT'*s Adjusting Crutch,* Plate IV.

THE stem of this crutch is formed of two lengths *d d* and *g g*, figs. 6, and 7 loosely bound together, by means of a screw *h*, the insertion of which is at the lower extremity of the upper piece, and about half an inch below the upper extremity of the lower piece. This latter, therefore, may be considered as a lever, of which the screw is the fulcrum. A moderately strong spring is secured to the upper piece of the stem, so as to act at *d*, on the short arm of the lever, and tending to throw it out of a vertical position. A mill-headed adjusting screw *f* passes through the nut *e*, and thus acts on the lever in a direction opposite to the spring, enabling the artist to obtain precisely the degree of obliquity required to put the clock into true beat.

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N°. VII.

SPRING CROSS FOR HORSES.

The small or Vulcan SILVER MEDAL *was this Session voted to* JOSEPH GOODWIN, *Esq. second Clerk of the Stables to his Majesty, for a* SPRING CROSS, *or* BREAK FOR HORSES. *The following communication has been received from Mr. G. on the subject, and the Machine has been placed in the Repository of the Society.*

Carlton Palace, April 30, 1821.

SIR;

THE Society of Arts, &c. having been pleased to consider the improvement I have suggested to the Colt-Breaker's Cross worth a place in their valuable volume, I send you a brief account of the advantages I consider to arise from its use, viz. an important auxiliary to the Colt-breaker, in conveying to the animal the first rudiments of mouthing and bitting, and, in some instances, in improving those mouths that have been rendered insensible to the proper use of the bridle.

A cross to obtain these ends is an old invention, though not in general use with colt-breakers; the method adopted by them, is to fasten the bridle reins on the saddle with a cir-

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cingle, thus confining the head to a fixed point; and, to lighten them sufficiently, the nose is brought in with the head down towards the breast; in this restrained awkward position the colt fixes his mouth on the bit, bearing hard on it without any change of position for a considerable time together; but on any little relaxation or movement of the mouth, he relapses into the same state again in a few seconds; in this way the mouth is rendered callous and insensible to the proper use of the bridle, and the head is brought too low, and, for the most part, disposed to bear hard and heavy on the hand of the rider or driver.

In order to obviate these inconveniencies, the cross was brought into use; by means of it, the reins were confined at any convenient height above the saddle, which had an advantage over the ordinary method in being able to raise the head and neck to any desirable height. The reins, however, being still a fixed point on the cross, the colt invariably resumed the inconvenient position of the old method. In order to counteract this inconvenience, springs fixed to the cross have been considered a useful expedient; although their employment has been very limited, and in the only instance which has come to my notice was but little calculated to answer the intended purpose. Under these circumstances, I resolved on bringing the machine into a more suitable form. Having done so, if, through the medium of the Society, it should be found as useful generally as it is considered in this establishment, the end I have in view will be obtained.

I wish, however, to be understood, that I do not, in proposing the use of the Spring Cross, anticipate that it is calculated to supersede the skill of the riding-master, it being admitted, that by his aid and delicate handling of the reins, that highly cultivated and sensible state of the horse's mouth, and all

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those pliant airs and graceful motions of the body, are only to be obtained.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. J. GOODWIN.

Reference to the Figures of Mr. JOSEPH GOODWIN'*s, Spring Cross, or Break for Horses,* Plate V.

FIG. 1, a front view; fig. 2, a side view, and fig. 3, a bird's-eye view: *a a*, the upper arms of the cross, perforated by loops to allow the play of the reins which pass through them to the springs *c c*; *b b*, guides through which the lower part of the reins pass to the springs *d d*; *e*, a central spring (with a guide staple *f*) to hold the bearing rein; *g g*, the lower ends of the cross to which the girth-bands are fastened. Fig. 4 is a section of the arms *a*, to show how the sides of the perforations or grooves are rounded, to prevent the reins from chafing. In the lower figure the cross is represented as fixed on the horse, from inspection of which it is evident, that though the horse can move his head freely in any direction, he can remain at ease only in that position in which he is required to carry himself.

The figures 1, 2, and 3, are one-twelfth of the real size.

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N° VIII.

BED FOR SURGICAL PATIENTS.

The large GOLD MEDAL *of the Society was this Session voted to* HENRY EARLE, *Esq. of George-street, Hanover-square, Assistant Surgeon at Bartholomew's Hospital, for a* BED FOR PATIENTS UNDER SURGICAL TREATMENT. *The following communication has been received from Mr.* E. *and a Model of the Bed has been placed in the Repository of the Society.*

28, George-street, Hanover-square,
Feb. 4th, 1821.

SIR;

You will oblige me by submitting the apparatus which will accompany this letter, to the inspection of the members of your Society. It was originally constructed for fractures of the thigh bone, especially when broken at its neck, close to the hip joint, but it has since been adapted to other affections. It will be right here to state, that such accidents are by far the most difficult to treat of any that occur to the human body, and an apparatus has long been wanted, capable of preserving the limb in a state of perfect rest, and maintaining the broken extremities of the bone in close apposition. On no subject, perhaps, is there greater difference of opinion among enlightened surgeons, than the best position and most

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approved method of treating fractures of the thigh. This diversity of sentiments is a sufficient proof, that perfection in this department has not yet been attained; but if any additional testimony were required, the numerous unfortunate cripples we daily meet in the streets, would afford abundant evidence. The fact is generally admitted, that no apparatus has hitherto been constructed, to which very material and valid objections may not be made, in particular cases, and under different circumstances, a detail of which, would be quite foreign to the objects of this Society. After premising thus much, it will appear bold in me to suggest any new plan of treatment; yet I flatter myself, that on a careful examination and fair and candid trial, the machine now submitted to your inspection will prove a practical and important improvement. One principal object requisite to the perfect union of broken bones, is uninterrupted rest, and this cannot be obtained in fractures of the upper part of the thigh, where the patient is obliged to be disturbed whenever he obeys the dictates of nature, an objection to which every apparatus hitherto constructed, is more or less liable. This appeared to me, at a very early period of my professional career, to be so great a defect, that I endeavoured to obviate it by inventing a bed for that purpose, for which I received an honorary medal from your Society. Further experience has enabled me to make great improvements, and to render it far more simple, less expensive, and more efficacious. The early fruit of my labours having been fostered by the Society of Arts, I think it but right to offer it to their consideration in its present more mature state. To enter into any discussion on the nature of different fractures, and of the causes which give rise to difficulties in their treatment, would be out of place here; but avoiding as much as possible all technical terms, I may briefly state the principal objects desirable

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to be attained in the treatment of fractures of the thighs. In the first place, the pelvis should be immovably fixed; for so central is the hip-joint, that the slightest motion of the trunk is immediately communicated to the upper part of the thigh-bone. Secondly, the position should be the least irksome possible, as patients are often obliged to remain in the same position, without moving for many weeks, or even months together. The position itself should be such as to keep the limb extended to its proper length, and to preserve the fractured part in close apposition, without making any undue pressure on any part, by which painful excoriation and ulceration are often produced. Next, the foot should be supported, so as to prevent it from turning out, from its own gravity or from the pressure of the bed-clothes; and lastly, it is particularly desirable, that the limb should be so placed as to afford every facility to frequent parison with the healthy limb.

The trials to which I have already submitted the accompanying apparatus will warrant me in stating, that it will be found to fulfil all these indications. In the first place, the pelvis will, from its own gravity, remain fixed at the bottom of the angle formed by the superior and central inclined planes, and the aperture made in the central parts, readily admits of the patient relieving himself, and being properly cleansed, without the least movement of either trunk or extremities. Should it be desirable in young persons, or under any particular circumstances, to secure the pelvis more firmly, it will be easily accomplished by two broad straps brought from the edge of the aperture, and passed round the upper and inner part of the thighs, which should cross each other behind the pelvis, and be fixed to buckles at the outer sides of the mattress. This addition will however be rarely required, except in fractures of the neck of the thigh bone. Next as to position, certainly, that on the back on a gently-inclined plane, with

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the thighs and legs half bent, and the whole equally and firmly supported on a level surface, is the one which can be the longest endured; and here I may mention, that at the time of my writing this, a patient has been for eight weeks recumbent on one of my beds, who has never once complained of the least uneasiness, but on the contrary, has been perfectly cheerful and happy. Next, the knee being bent over a double inclined plane, affords the best means of making permanent extension, by placing a fulcrum under the ham, and making a lever of the leg, whilst the foot is securely fixed to the foot-board. Thus all the advantages arising from the bent position, namely, the relaxation of the most powerful muscles, and the permanent extension afforded by the straight position, are united, without the patient being subjected to the inconveniences of either, and without the aid of splints or bandages to the broken limb. The gradual curve formed by the mattress, is exactly adapted to the natural arched form of the thigh-bone, and is the least likely to cause any derangement in the length or direction of the broken limb. The fixing of both feet prevents the possibility of moving the pelvis, which a patient is apt to do when one is left at liberty. The juxta position of the limbs affords constant opportunity of minutely comparing them, and of observing whether they exactly correspond. The apparatus for fixing the feet, at the same time supports the bed-clothes and maintains the whole limb in its proper position.

I have stated that this apparatus was first constructed for fractured thighs, but I have since employed it, with marked advantage, in active diseases of the spine; and it is particularly adapted to diseases of the hip-joint, and many other injuries and diseases, where permanent rest is essential to perfect recovery. In applying it to cases of diseased spine, I have added a trap-door and moveable portion of mattress to

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the upper inclined plane, similar to the one in the central portion, which is destined for the evacuation of the fæces. The exact situation of this upper aperture, must be regulated by the individual case to be treated, as disease may occur in any part of the spine. This addition will be found most useful in enabling surgeons to apply leeches, and dress issues or setons without at all disturbing the patient, and thus interrupting the reparative efforts of nature. For the additional comfort of those who are capable of mental recreation from study, I have added a swing table and reading desk, which will support a book over the patient's head, without any effort on his part. In constructing this bed, I have as much as possible studied to combine simplicity and economy with convenience and utility. The whole apparatus I have had made by Mr. Cook, of 8, Denmark-street, St. Giles's, for five guineas, and it is probable, that when more have been made, they may be manufactured at even a lower price. In conclusion, I shall take the liberty of strongly recommending its adoption on ship-board, where so much difficulty must necessarily attend the proper treatment of complicated accidents, and gun-shot wounds, where the slightest motion must often renew and render fatal hæmorrhages, which might perhaps be restrained by uninterrupted rest. When the apparatus is not wanted for any accident or disease, the inclined planes may be let down, and it will then form a small commodious bed, not occupying more space than a common hammock. I beg to apologize for the length of this letter, and

am, Sir,

&c. &c. &c.

HENRY EARLE.

P. S. I have declined sending any testimonials in favour of this apparatus, excepting from those medical gentlemen

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who have either employed it themselves, or witnessed its application in different cases. I may however state, that I have shown it to many of the most respectable men in the profession, who have all expressed themselves well satisfied with its simplicity, and the prospect it afforded of being extensively useful.

DEAR SIR; Golden-square, March 2, 1821.

I HAVE had great pleasure in examining the bedstead with a double inclined-plane, and have since seen it practically applied to an important case of diseased spine; it appears to me to accomplish the very essential purpose of absolute rest in such cases, as well as those of fractures and other diseases of the upper part of the thigh and pelvis, more completely than any contrivance we have yet had the use of; but the particular advantage it appears to me to afford, is that of allowing the necessary applications to be made, and the necessary discharges removed without disturbing the patient, or the parts whose recovery depends on complete rest.

I remain, Sir,

&c. &c. &c.

T. COPELAND.

Dartmouth, Feb. 24th, 1821.

DEAR SIR;

ALLOW me to express my real and candid opinion of your invention, the double-inclined plane bed. The principle on which it is constructed, and on which it acts, is most excellent for fractures of the bones of the pelvis, for fractures of the thigh, *cervix femoris*, diseases of the hip-joint, as well as diseases and injuries of the spine. It cannot indeed be exceeded whenever uninterrupted rest is required, as by means of the

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trap-doors, the alvine and vesical discharges pass off without trouble or inconvenience, sine minimâ aut lecti aut vestis inquinatione; and if setons or issues are required in any part of the back or neck, they can be dressed and kept clean by the same contrivance, without the slightest motion of the patient's body, which is certainly the greatest desideratum in all such cases. When any of the above accidents happen, and patients are placed on a common bed, the fractured limbs are necessarily disturbed whenever the calls of nature occur, to their great injury, oftentimes preventing a nice coaptation of the broken ends of the bones, and thereby frequently causing great deformity of the limb; all this your improved apparatus most completely obviates. It is therefore my decided opinion, founded not only on the instance in which I witnessed your application of it to a near relative of my own, but on the experience which I have since had in my own practice, that when once these beds shall be made known to the faculty, their use will become general.

I remain, Sir,
&c. &c. &c.
W. J. HUNT.

DEAR SIR; Brunswick-square, 17th March, 1821.

I HAVE no hesitation in expressing my decided approbation of your apparatus, for the treatment of fractures of the femur, the efficacy of which I have recently witnessed in a case of the most unfavourable description. It appears to me to afford perfect security against shortening of the limb, and that too with very little inconvenience to the patient; which can be said of no other apparatus, or plan of treatment that has come under my observation.

I remain, Sir,
&c. &c. &c.
G. DARLING.

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DEAR SIR; 28, George-street, Hanover-square, Oct. 30th.

As the volume of the Transactions has not yet gone to press, I may perhaps be allowed to address a second letter to you on the subject of my invalid bed. It may perhaps be satisfactory to the members to be apprised, that since my first communication, it has been extensively employed in the wards of St. Bartholomew's, and has essentially contributed to the recovery of several complicated accidents, and compound fractures of the leg and thigh. In diseases of the spine, requiring the use of issues, it has been employed with advantage at the same institution; and at the present time, there are four cases of this description under treatment. It has also been adopted by several other hospitals, and by many practitioners. In my own private practice, I have likewise found it afford the greatest comfort and security; and in one case of diseased spine, by adapting the apparatus to a very easy chariot, I was enabled to remove a patient who had been ten months confined to bed, a distance of one hundred and eighty miles in two days, without her experiencing any inconvenience. To prevent any possible mistake, I shall subjoin some directions to be observed by persons employing this apparatus.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. HENRY EARLE.

Directions for using Mr. EARLE'*s Fracture-bed.*

DURING long confinements to bed, particularly when it is necessary to preserve the same position for weeks and even months together, it is of essential importance to the comfort

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of the patient, and often to the success of the practitioner, that great attention should be paid to render the bed as permanently level and smooth as possible. This I consider of so much consequence as to merit the attention of the surgeon, who ought never to place a patient under such circumstances on *any* bed, until he has himself minutely examined it. To some gentlemen this may possibly appear unnecessary; but I can practically assure them, that this little preliminary trouble will very often save them much subsequent anxiety and vexation, and mainly contribute to the happiness and comfort of their patients.

In constructing this apparatus, I have bestowed considerable pains in endeavouring to alleviate the sufferings of persons labouring under complicated accidents and diseases; in doing so, however, I have by no means exempted the surgeon from that part of his duty which I have above alluded to, and in the employment of this bed, I would particularly call his attention to the following directions: The mattress should be either of horse-hair, or well stuffed with the best wool, and should be nailed round its edge to the upper division of the frame. A blanket and sheet should be separately strained over the mattress, and carefully sewed all round its edges: this will prevent any subsequent wrinkling, and by sewing first the blanket, and then the sheet, it is obvious that the latter may, if necessary, be detached without at all disturbing the former. The whole apparatus is made narrow, both to facilitate the operations of the surgeon and nurse, in dressing or cleansing the patient, and to prevent him from shifting from the central aperture. Half a blanket, and a single breadth of sheeting will in all cases be sufficient; and in fitting them to the central aperture, as well as the spinal opening when used, it is far better only to make a cross cut from the four corners thus ⋈ than to remove any part.

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The loose edges should then be turned down, and sewed at the lower part of the opening. By this plan, any hardness of the edges of the aperture will be avoided.

If the case about to be treated be a compound fracture, and there is a probability of profuse discharge, it will be well to add some oil silk, or a draw sheet, under the part affected. If the case be a disease of the spine, the trap-door and moveable pad should be accurately adapted to the part, before the patient be placed on the bed. In fractures of the lower extremities, the length of the limbs should be taken, and the central portion and foot-board lengthened or shortened accordingly. In complicated cases, where both upper and lower extremities are injured, the addition of the shelf for the support of the arm will be found a great comfort. This was employed with advantage in the case of Turner, who committed the forgery on the Bank of England, who fractured his elbow and hip-joints. The position best adapted for fractures of the thigh, is shown in the right division of figure 1. The same will be found best for affections of the spine and hip-joints.

The position shown in figures 2 and 6, with the lower division horizontal, is the one in which I have placed compound fractures of the leg.

In fractures of the knee-pan, it may be elevated, as shown in the left division of fig. 1, and by the dotted lines in fig. 2, in order to relax the powerful muscles in front of the thigh.

In placing a patient on this apparatus, care must be taken to fix him with the nates directly opposite the central opening, and the nurse should be directed to be very careful to introduce the proper utensil, so as to come in contact with the patient. It occasionally happens, that at first patients experience a difficulty in performing their natural functions in the recumbent position: this will soon be overcome, by raising the upper division a little. In some rare instances, I have

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found it necessary at first to employ a catheter; but this difficulty is far greater when any other apparatus is employed, and, generally speaking, the proper employment of this bed will obviate it altogether.

Description of Mr. EARLE'*s Bed for Invalids,* *Plate IX.

THE apparatus consists of a strong fixed frame *a a*, which is rabbeted, as shown at *b b*, figs. 1 and 2, to receive a moveable one of the same length, but about 3 inches narrower. The moveable frame is divided into three parts, connected by joints; the superior one *c c*, is the longer, and is intended to support the head and trunk. The middle division *d d*, which is the shortest, is adapted to the thighs, and is capable of being lengthened, or shortened, as seen at *w x*, figs. 5 and 6. The inferior one *e e*, *f f*, is intended for the legs. This latter part is divided up the middle, for the convenience of varying the position of either leg, as shown in fig. 1. The right division *e e*, is the proper position for fractured thighs; the left division *f f*, for fractures of the knee-pan. The moveable frame is connected with the fixed one, by means of the iron pivots *g g*, which turn in the sockets, which are screwed to the outer frame, at the junction of the upper and middle divisions. Different degrees of elevation may be given to the different divisions by props, one *h h*, under the upper, the other *i i*, under the middle division. These props work in racks at the bottom of the rabbet *b b*, of the fixed frame *a a*. The two portions of the inferior division *e e*, *f f*, are maintained in their different elevations, by means of the wooden uprights or props

* N. B. The letters of reference are the same in all the figures.

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s s, which are fixed to the upper frames, by hinges formed with two staples or iron rings. These props are notched at one side, at given distances, and can be dropped upon the screws, which are fixed to the inside of the fixed frame, as best seen in fig. 3. The whole moveable frame is boarded over, and should be bored with numerous gimblet holes to admit air, and prevent the perspiration from rotting the bedding. A well-stuffed hair or wool mattress *k k*, figs. 1, 2, and 4, is fitted to this, which is nailed to the edge of the upper and middle divisions, but left free at the lower division, to enable the apparatus to be fitted to limbs of different lengths. The central division *d d*, has a long narrow trap-door *l*, about 3¼ inches wide, and a foot long, which can be let down for the admission of the proper utensils, figs. 7 and 8, fitted to the opening. The mattress at this part has a corresponding vacancy, which is filled up, when not used, by a pad adapted to the opening. A similar trap-door and moveable pad may be made in the superior division at *m*, for the convenience of dressing issues or setons in cases of diseased vertebræ, where the slightest motion of the body should be avoided. The situation of the latter opening, and its length, must vary according to the part affected in the individual to whose case it is adapted; but it should not exceed six or seven inches in width, for fear of taking off too much of the support of the body. When the spine is in a very tender state, the firm pad should be exchanged for a softer one, made with feathers. The rest of the apparatus consists of two pieces of wood *n n*, shaped like the soles of the feet, through which an iron rod *o o*, passes, which is affixed, by two thumb-screws, to two uprights which rest by a broad base on the edge of the inferior division *e f*, and are confined in their situation by screws, which fit into iron plates, with holes at the interval of one inch, to adapt it to legs of different lengths. To these foot-

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boards the feet are firmly fixed in fractures of the lower extremities, and in most cases this will supersede the use of splints. A reading-desk *q*, and swing table *r*, have been subjoined for the additional comfort of patients. These are attached to the upper frame, in the same way as the uprights of the foot-boards. The reading-desk will support a book over the patient's head, without any effort on his part, as seen in figs. 1 and 2. On each side of the fixed frame, in figs. 4, 5, and 6, iron sockets *t t*, are affixed to receive the uprights *u u*, which support the shelf *v v*, which is intended to support the arm and fore-arm, in case of a complicated injury to the upper and lower extremities: this may be raised to different elevations, and retained by pins passing through the uprights into the iron sockets.

Fig. 1 shows the apparatus complete, with the reading table. The trap-door for the spine is left open, and the two portions of the inferior division are placed at different elevations; that on the right side is the position for fractured thighs, that on the left for fractured knee-pans.

Fig. 2 gives another view of the apparatus, showing the situation of the central opening, and the inferior division in the horizontal position, adapted to fractures of the leg.

Fig. 3 shows the under side of the apparatus, with a view of the whole mechanism by which it is worked.

Fig. 4 shows the apparatus when not in action.

Fig. 5 gives a view of the upper surface, and shows the mode by which the central division may be lengthened or shortened.

Fig. 6 gives an outline of the frame in the position for fractured legs, with the addition of the shelf for fractured arms.

Fig. 7, the utensil adapted to the size and angle of the central opening.

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Fig. 8, urinal for men, particularly in cases of paralysis of the bladder, accompanied with incontinence of urine.

Fig. 9, side view of the upright which supports the foot-board.

N° IX.

ORTHOMETER AND PLEOMETER.

The small or VULCAN GOLD MEDAL *was this Session voted to Mr.* JACOB PERKINS, *of Fleet-street, London, for two instruments for ascertaining the Trim of a Ship more accurately than can be done by the methods usually practised. Models of the instruments are placed in the Repository of the Society.*

69, Fleet-street,
February 26th, 1821.

SIR;

IF the Society of Arts will have the goodness to examine two instruments (one of which is denominated an Orthometer, the other a Pleometer), calculated to facilitate the sailing of ships, &c. I shall take great pleasure in submitting them for their inspection.

I am, Sir,
&c. &c. &c.
JACOB PERKINS.

A. Aikin, Esq.
Secretary, &c. &c.

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As the construction of both these instruments is the same, differing only in the relative proportion of the parts, one description will serve for both. The instrument is in fact a mercurial level, consisting of a horizontal tube turned up vertically at each end, to the height of about three inches. This tube or syphon is filled with mercury, so that the fluid rises up about an inch in the two legs, to each of which a float is fixed, forming one end of a lever, as the index does the other end, which is so adjusted that the two indexes are in the same horizontal line when the mercury stands at the same height in both the legs; but when the mercury is unequal, then the indexes are, the one higher and the other as much lower than the horizontal line. Two instruments of this kind being fixed against the side of a ship's cabin, one in the same line with the keel, and the other at right angles to it, will show by changes in the relative position of the indexes, the angular changes in the position of the ship itself, occasioned either by the distribution of the cargo, or by the impulse of the wind on the sails.

The instrument is suspended by two points, one of which is fixed; the other is capable of being raised or lowered by an adjusting screw. As however, from the pitching and rolling of the ship, the mercury would be in a state of constant and violent oscillation, so as to render any accurate observations impossible, the inventor has obviated this difficulty by fixing a perforated screw upon the middle point of the horizontal part of the tube, by means of which the bore in that part can be diminished to any required degree, so as to render the instrument insensible to individual and sudden changes in the position of the ship, while it continues to indicate the average inclination of the vessel.

When the vessel is at sea, and sailing to the most advantage, the adjusting screw of the instrument is to be turned till

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the two indexes are brought into the same horizontal line, and this adjustment will ever after continue to indicate the trim of the vessel, as long as no material change in the quantity and position of the cargo takes place. Hence by mere inspection of the instruments so adjusted, the master will know whenever his ship is or is not sailing to the most advantage.

The instrument placed in a line with the keel of the ship is denominated by Mr. Perkins an Orthometer, that placed at right angles to the keel a Pleometer.

Reference to the Figures of the Instruments. Plate VIII.

Fig. 1, front view of the Orthometer; *a a*, front plate which protects and covers the machinery; *b*, screw pin on which the Orthometer is made to swing; *c*, adjusting screw for raising and depressing that end of the instrument to which it is attached; *d*, an aperture cut in the front plate, showing the two indices and the graduated arcs on which they traverse; *e*, the square head of the stop-cock, for regulating the passage of the mercury; *f f*, screws for fixing the floats when the instrument is not in operation, and to prevent the escape of the mercury.

Fig. 2, top view of the Orthometer; *m m*, the back plate in which the machinery is fixed.

Fig. 3, section of the Orthometer; *m m*, the back plate; *g g*, floats resting on quicksilver in the vertical tubes *h h*; *i i*, horizontal connecting tube; *j j*, indices or hands; *e*, regulating stop-cock; *k k*, fulcrums for the index hands; *l l*, screw pins for uniting the lower and upper parts of the instrument; *d*, index plate for denoting the trim of the ship.

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Fig. 4, section showing, on a larger scale, the regulating stop-cock, *e*. The perforation is made conical to allow of more accuracy in its adjustment.

Fig. 5, bottom part of fig. 3.

Fig. 6, section, on an enlarged scale, of part of the Orthometer, showing one of the index hands *j*, and floats *g*, resting on the quicksilver in the vertical tube *h*.

Fig. 7, front view of the Pleometer; *a a*, front plate; *b b*, screw pins to fix the instrument to its place; *e*, regulating stop-cock; *d d*, index plate showing the careen of the ship.

Fig. 8, end view of the Pleometer.

Figs. 9, and 10, view of the Pleometer, the upper and lower parts of the case inclosing the machinery being separated; *g g*, floats for raising and depressing the index hands *j j*; *h h*, vertical tube containing quicksilver; *e*, regulating stop-cock; *i i*, horizontal tube connecting the vertical tubes *h h*; *k k*, fulcrums for the index hands; *d*, index plate; *l l*, connecting screw pins.

Fig. 11, section of one end of the Pleometer, and of part of one of the index hands on a larger scale; *g*, the float resting on the quicksilver in the vertical tube *h*; these floats are hollowed to admit the rods *n* to play therein, and preserve the parallelism of the motion of the floats in the vertical tubes *h h*.

Fig. 12, screw of the regulating stop-cock *e*, full size; *o*, conical aperture, through which the quicksilver flows in its passage from one vertical tube *h* to the other: by turning the screw more or less, the flow of the mercury is regulated so as to partake of the mean motions of the vessel, but not to be continually agitated thereby; and, by turning the screw *e* a little more upwards than is shown in fig. 4, the small conical hole will be entirely closed, and the flow of the mercury prevented.

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N° X

FIRE-ESCAPE.

The sum of TEN GUINEAS *was this Session given to Mr.* GEORGE ADAMS WITTY, *of Frances Place Holloway, for a Machine to facilitate* ESCAPE FROM A HOUSE ON FIRE. *A model of the Machine is placed in the Repository of the Society.*

MR. WITTY's fire-escape resembles, when folded up, a small settee, being furnished with arms, cushions, and a cover, all of which are easily removeable, and have nothing to do with the machine when used as a fire-escape. Implements of this kind are generally unsightly, and not applicable to any use except that for which they were primarily intended; the natural consequence of which is, that they are put out of the way and neglected, so that when wanted on a sudden emergency, they would probably not be forthcoming. It is this consideration which has induced Mr. Witty to convert his Fire-escape into an elegant and convenient article of furniture, the natural position of which would be the recess of a window in a bed-chamber, which is the precise place where, in case of fire, it would be most conveniently used. Plate VI, fig. 1, exhibits the instrument in this state.

Fig. 2 is the seat (without the cover) as removed from the

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chair fig. 3, which is now ready to be put out of the window; fig. 4 represents it hanging on the window cill, like the painters machine; *a a*, section of the window cill and wall; *b b* and *c c*, the chair or machine; the top *b b*, which hooks on the window cill, has iron points at *e e*, which, sticking in the cill, prevent the possibility of any accident moving it; *d d* is the bag shown hanging in its place, fig. 4, but packed up in figs. 3 and 5, by means of two straps *f f*, which are fixed at the bottom of the bag, and squeeze tightly under the springing piece of wood *g*; these are pushed out and the bag falls between the frame into its place, as fig. 4; the bag is kept open by being made fast to a strong frame, and well secured by girth-web, which passes under it, and by which it hangs; these webs go over rollers at *h h*, and pass on to the end of the upper roller *i i*, where a sufficient quantity is coiled round to reach from the top of the house to the bottom. When a person gets into the bag, it begins to descend, as in fig. 4, and as the web uncoils itself from the rollers *i i*, it causes the flexible rope *k* to wind round the middle part of the roller *i i*; a person within the room lays hold of this rope to prevent the too rapid descent, and if that is not enough, the handle of the break or regulator *l* is raised by him. Fig. 6 shows the roller *i* in section, with the web *m m*, wrapped round it, and tightened by the lever *l* of the break; the rope *k k* is folded up, and lies at the back of the chair under the seat, as in fig. 3, when not in use.

In case of alarm of fire, take off the seat and cover by the two arms and throw it entirely away from you, it then appears as fig. 3; pull the chair over towards you as it stands, and lift the seat part through the window, the top *b b* which contains the roller *i i* catches withinside the cill of the window-frame, as fig. 4; the chair adjusts itself instantly on the same principle as the painter's machine, and requires no kind

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of fixing or fastening whatever, but is perfectly ready for a person to descend, which may be done from a four-story window to the street, in half a minute from the time of getting out of bed. To rescue a family, one person will manage it for the whole. Observe, on putting the machine out, a rope *k* falls at your feet, which winds on the roller as the bag descends; when one person is down, draw the rope, and the bag ascends for another, or two or three children may descend at once; each descent occupying about one minute, a family of twelve persons may be saved in as many minutes: at the right-hand end of the roller is the break or regulator, by merely lifting which, you will prevent the too rapid descent of a great weight; but this is not of importance, as the same may be done by the rope, but not so easily as not affording so much purchase on the roller. When all are down but the person who conducts the machine, he will enter the bag, taking the rope *k* with him, and let himself down; after which, should any one appear at the window, he may, while in the street, draw the bag up to them and let them down; should the bag ever be destroyed after the first descent, the rope (which is a patent one) may be thrown out, and being held by a person at a distance, a descent may be attempted by sliding down it; and should both fail, in the greatest extremity four persons might sit on the machine outside the window, thus affording time to bring fire-ladders, &c. for their relief. In many of the awful calamities that have happened by fire, it is to be lamented there has been no means of saving women and children. The construction of the escape-chair will be found so secure, that the most aged or helpless person that can be got through the window, may be saved by it; and so simple in its operation, that any grown person, male or female, will find no difficulty in the use of it.

GEORGE ADAMS WITTY.

Frances-place, Holloway.

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N° XI.

STOVE FOR VENTILATION.

The Thanks of the Society were this Session voted to Mr. JACOB PERKINS *of Fleet-street, London, for his Method of* WARMING AND VENTILATING ROOMS.

THIS communication may be considered as a continuation and improvement of that, by the same candidate, which gained the large Silver Medal of the Society, and is inserted in the last volume of the Transactions, p. 80. The principal improvement indicated in that communication is the introduction of an abundant supply of external air, which, by a very simple apparatus, is brought in contact with the outer surface of the stove, and is thus raised to a moderate and agreeable temperature before it is poured into the room.

In the present plan the horizontal air-trunk remains as before; the stove itself has undergone some modifications, enabling the operator to produce at pleasure an ascending or descending draft through the fuel, by means of the latter of which, the smoke is wholly consumed. The chimney of the stove is surrounded by a vertical air-trunk, fitted with valves in the proper places, by means of which the heated air may be distributed at pleasure to one or more upper floors.

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This plan, which theoretically appears very sound, has been carried into practice, on a large scale, with perfect success, at a printing-office in the Old Bailey, in the occupation of Mr. T. C. Hansard, where the ordinary means of producing the required heat, by two fires in each room, had proved insufficient.

The moderate original cost of the apparatus, the considerable saving in fuel, and its very general applicability to workshops and drying houses of every description, have induced the Society to give it a place in the present volume.

Reference to the Engraving of Mr. JACOB PERKINS'*s, Warming and Ventilating Stove,* Plate VII.

FIG. 4, section of the stove; *i*, the mouth in which the fuel is put: *k*, the valve or lid to shut it; *l*, the grating hinged at the back, and held up in front by the iron button *m*; *n*, the ash-pit, which is quite close, all but the opening *o*: this is opened and the lid *k* shut while lighting the fire; but when this is done, and the flue *p p* has become warm enough to produce a draught, the valve *o* is shut, and the valve *k* opened more or less, to supply or regulate the draught, by which means the smoke is effectually consumed; the lower part of the flue *p* is spread out at bottom nearly as wide as the stove (as seen in the plan fig. 5); *q q* is an air-trunk supplying fresh air from the outside of the house; this is directed by an iron screen *r r*, so as to impinge on the flue and stove and become effectually warmed as it passes in; *s s* is a hood or trunk surrounding the flue; this draws in much of the fresh air, and conducts it, still hot, through the ceiling into the next floor by the opening *t*, as shown by the arrows; above this opening is

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a register *v*, to stop the air from continuing its course to the third floor; or, if there is too much in the second, to let a portion escape to the third floor (a bird's-eye view, fig. 6, shows this register partly open); when the register *v* is closed another current of fresh air comes in from without through a second air-trunk *u*, and continuing its ascent, comes out warmed at *s s*, fig. 7, into the third floor; *w w*; fig. 4, is the floor of the second room, and *x x*, fig. 7, the third room floor, *y* is a grating or partial damper; it prevents the passage of lighted shavings or paper into the chimney, and is shown separate, fig. 8; *z z*, an iron plate through which the elbow passes into the chimney; there is an opening in the elbow, with a sliding cover; *a a*, figs. 4 and 7, are hooks of iron rod to bear the weight of the trunk *s s*.

N° XII.

DOUBLE DOOR-HINGE.

The small or VULCAN SILVER MEDAL *of the Society was this Session voted to Mr.* SAM. LAKE, *of Alfred-Place, Bedford-Square, for a* DOUBLE DOOR-HINGE, *a Model of which is placed in the Repository of the Society.*

MR. LAKE was employed by Sir J. Lubbock to make a door of communication between two rooms, so as to answer the following conditions: that the door be hung on a single jamb or post, that it be divided into two leaves, so that the outer one,

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when necessary, may be folded back flat to the inner one, by turning either to right or left at pleasure, and that the leaves may, on occasion, be fastened together so as to act as a single leaf.

These conditions are fulfilled by Mr. Lake's Door-hinge, and the same contrivance is obviously applicable to a window-shutter.

Reference to the Engraving, Plate VII, Figs. 1, 2, 3.

A B, the middle style of a double-margined door; F, the hinge having two joints *e c*, and consequently three flaps, by which the door will fold on either side, as represented by the dotted lines B on one side, and B *g* on the other side (fig. 3); D, the bolt which, when pushed down, shuts into the staple *e* on the middle flap, and thus fixes one of the joints: the hinge then acts as one on the common construction, and will fold only on the side B *g*; then, by sliding the bolt H (fig. 2) on the top of the door, the double hinge is prevented from acting, the two leaves are secured together in the same plane, and the door opens as a single one, moving only on the hinges attached to the door-post.

Figs. 1 and 2 are elevations; fig. 3 is a horizontal section through the top of the hinge.

Figs. 1 and 3 are $\frac{1}{4}$ of the real size.

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N° XIII.

SETTING CUTTING INSTRUMENTS.

The Thanks of the Society were this Session voted to GEORGE REVELEY, *Esq. of Queen-square, London, for a communication on the use of Soap instead of Oil in* SETTING CUTTING INSTRUMENTS ON A HONE.

Queen-square, Bloomsbury,
January 8th, 1821.

SIR;

I BEG to communicate to the Society of Arts, for the benefit of the public, a new method of setting razors by substituting soap instead of oil. Not having any oil to set my razor, it occurred to me to try the soap I was washing with, called palm soap, and I found it so completely to answer my purpose, that I have constantly used it ever since, instead of oil, both for razors and pen-knives. It sets quicker, gives a good edge, and removes notches with great facility; it is a more cleanly material, oil being liable to drop on and soil any thing it comes in contact with; dust will frequently get into oil, which will spoil the edge, and in such case it must be changed. It is as cheap or cheaper than oil, a small square of palm soap costing only three pence, which will last for a great

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length of time. The operation is performed as follows: having first cleaned your hone with a spunge, soap, and water, wipe it dry; then dip the soap in some clean soft water, and wetting also the hone, rub the square of soap lightly over it, until the surface is thinly covered all over; then proceed to set in the usual way, keeping the soap sufficiently moist, and adding from time to time a little more soap and water if it should be necessary. Observe the soap is clean and free from dust before you rub it on the hone; if it should not be so, it is easily washed clean; strop the razor after setting, and also again when you put it by, and spunge the hone when you have done with it.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEO. REVELEY.

Queen-square, Bloomsbury,
February 9th, 1821.

SIR;

I HEREWITH send Certificates respecting my method of setting razors, which also includes workmen's tools; the fact thereby established of setting quicker, is important, as one-fourth in time gained by those who are employed in setting a considerable number of razors, &c. is an object both as to convenience and in saving expense; the excellent state in which it keeps the hone, is also an object both in respect to cleanliness, and the advantage of its surface being kept in a better state for action than when oil is used. With respect to novelty, I only can say I never heard of any one having used it, or received any information from any one on the subject of setting with soap previously to my making the communication to the Society, nor can I learn, on inquiry, that it is known to the

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public. You will have the goodness to communicate the contents of this letter, and also of the certificates, to the chairmen and the gentlemen of the Committee of Mechanics.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. GEO. REVELEY.

CERTIFICATES.

SIR; 9, Boswell-court, Queen-square.

I HAVE tried Mr. Reveley's discovery, and am of opinion that the use of soap for the setting of razors, is preferable to that of oil, because they are set quicker, and I think much better; besides, the operation of setting may be performed with a greater degree of cleanliness.

I have set the razors in the following manner: those marked X are set with palm soap, those marked \ with common soap, and those marked / / with oil.

A. Aikin, Esq. WM. WEST, *Razor-maker,*

Secretary, &c. &c. *and Working-cutler.*

SIR; Poultry, February 22th, 1821.

AFTER repeated trials of Mr. Reveley's method of setting razors with soap and water, instead of oil upon the hone, I am of opinion that it is much more cleanly and quicker in producing the required edge, and certainly better calculated for the travelling case of an amateur of that useful art.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. W. H. PEPYS.

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GENTLEMEN; 217, Holborn, Feb. 23rd, 1821.

Being an invalid prevents me the honour of attending your Committee this evening, on the subject of Mr. Reveley's employment of soap instead of oil for setting razors, &c.

After having made repeated trials of this new mode of setting razors, I am in candour bound to give it my support; for many purposes it is equal, and in some I think it is superior to the finest oil commonly used for setting cutlery, and edge tools in general.

I am, Gentlemen,
&c. &c. &c.
Richard Long.

55, Southampton-Row,
SIR; Feb. 8th, 1821.

For the convenience and advantage which I derive from your kind communication, as to the use of soap in lieu of oil, I beg you will be pleased to accept my sincere thanks. I have almost daily some fresh instance of its utility. My workmen assure me, that in setting their tools, they can do it both quicker and better than with oil.

And in point of cleanliness there is certainly no comparison between the one and the other. Until you kindly informed me of this use of soap, our oil-stone had been a continual nuisance, perpetually daubing and injuring one article or another; but by the adoption of your plan, all this inconvenience has been completely removed.

By widely communicating this truly useful discovery, I am convinced, Sir, you would be rendering an essential benefit to a great number of mechanical trades and would have many thankful acknowledgments from those who are at present unacquainted with it.

I am, Sir,
&c. &c. &c.
Isaac Frewer, *Saddler.*

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In addition to the preceding letters and certificates, it is only necessary to state, that both Mr. West and Mr. Pepys made trial of Mr. Reveley's method in presence of the Committee and to their entire satisfaction.

The saving, in point of time, observed by all who have made comparative trials of oil and soap, will probably be accounted for from the following considerations: If a blade of steel is drawn along a dry hone, certain parts of the hone will be found to be covered by a thin film of steel, abraded from the blade, and now adhering so firmly to the hone, as to prevent its action in the parts thus covered. Having removed the film of steel by means of a pumice stone, and dropping a little oil on the surface of the hone, it will now be found that the abraded particles of steel are suspended in the oil, which thus becomes discoloured, while the whole surface of the hone continues to act on the oil, except where, from the irregularities of the stone or the oblique position of the blade, a thin stratum of oil happens to be interposed. In this case, the tenacity of the oil preventing it from yielding readily to pressure, the blade is apt to slide a considerable distance before it again comes in contact with the surface of the stone. The tenacity of soap and water is by no means equal to that of oil, though capable of holding the abraded particles of steel suspended in it, hence the quantity of effective cutting surface of the hone is increased.

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N° XIV.

CUTTING THE DIVISIONS ON CIRCULAR ARCS.

The large SILVER MEDAL *was this Session voted to Mr.* JAMES ALLAN, *of Blewitt's Buildings, London, for his method of* CUTTING THE DIVISIONS ON CIRCULAR ARCS.

IN the Session 1809-10, Mr. Allan received the Gold Medal of the Society for his Mathematical Dividing Engine, in which, besides other peculiarities of construction, his method of cutting, correcting, and equalizing the teeth of the rack, which forms the periphery of the circle, attracted particular notice and observation, not only on account of its novelty, but because it seemed better calculated than any other mode hitherto practised, to insure the utmost possible accuracy of division. A description of this method, with an explanatory plate, is inserted in the 28th Vol. of the Transactions of the Society. The soundness of the judgment thus pronounced by the Society, was most satisfactorily and agreeably confirmed by the Board of Longitude, who, after a very careful examination of the instrument itself, and of its performance, as compared with that of the most celebrated dividing Engines, granted to the ingenious inventor, in 1820, the sum of one hundred pounds, as a testimony of their approbation.

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The Society, concurring with the earnest desire of the inventor (now unhappily no more), to give to the public all the peculiarities of construction by which his Dividing Circle is characterized, have now completed their purpose.

The present paper therefore contains a description of the apparatus attached to the cutter, by which the necessity of bounding arcs for regulating the length of the divisional lines, is avoided; and secondly, of the apparatus for stopping the tangent screw, so as to prevent the possibility of any overrunning of the teeth composing the circular rack, and therefore of obviating any inequality from this source in the divisions cut by the engine.

In the usual way of dividing circular limbs of mathematical instruments, the cutter is moved by the hand of the artist, and therefore, to insure the proper length of the lines, three bounding concentric arcs are first described, within which the lines are placed. But even this precaution is not sufficient, unless a magnifier is attached to the cutter, so as to enable the artist to see its point while he is moving it. The consequences of this are, first, a great strain on the eyes from the constant use of the magnifier, and secondly, a great loss of time, not to mention that, as the longer divisions necessarily pass through the intermediate bounding arc, the point of intersection is deeper than the other parts of the line, and the cutter is liable to have its point injured by the kind of trip thus occasioned.

The cutter of Mr. Allan's engine is placed in a kind of cradle-frame, the motions of which are limited by stops actuated by pressing the fingers on two small treadles, by means of which, the length of the lines is regulated with the utmost precision; while an equal depth in the lines is insured by placing ring weights on the cutter, so as to supersede the necessity of pressure by the hand. This contrivance, though

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new in its application to the division of arcs, appears to have been in part and occasionally made use of by the late Mr. Harrison, in dividing right-lines.

CERTIFICATES.

19, Newcastle-street, Strand,
March 14th, 1821.

SIR;

In compliance with your wish, I send you my opinion of your new method of cutting mathematical divisions, which I have no doubt is superior to any other hitherto in use; I feel myself justifiable in saying thus much, in consequence of the satisfaction the Theodolites and Sextants you divided for me have given. I do not mean your lines of division, being so nearly in their true places; that has already very justly been noticed and rewarded by the Society of Arts, and Board of Longitude; the present business is your method of cutting those lines, which, in my opinion, does not admit of a question; for every person must, and does know, that when a point cuts lines with a weight or load upon it, the lines will have a greater degree of equality and sameness than when done by the guess and pressure of the hand; the good effect of which is, that the minutes and seconds are much easier read than when there is any inequality in the cutting. I consider likewise that your omission of circular lines is an improvement, because your lines are so exactly of a length that they become a circle themselves, which in point of effect has a more delicate and mathematical appearance, the circular lines being of no other use than a boundary to the divider.

I remain, Sir,

&c. &c. &c.

J. Corless, *Mathematical Instrument-maker.*

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SIR; London, May 2nd, 1820.

HEARING you intend to become a candidate for an additional honorary premium from the Society of Arts, on the subject of your improvement of Mathematical Instruments, I have much pleasure in being able to state, from very considerable experience, the superiority of your method of dividing the limbs of sextants, circles, &c. with uniform delicacy of line, and without circular sweeps.

Your Self-correcting Dividing Engine had formerly insured equal division, and your application of equal pressure in cutting the degrees and minutes, makes every line, and all the lines throughout, of such uniform strength, that I never found any difficulty in reading off the arch to a greater nicety than the vernier was cut to. Thus, in an instrument made to show the arch to 15 seconds, I seldom had any difficulty in ascertaining whether it was one-half, or one-third that quantity more or less; and in your pocket sextant with tangent screw, cut to 30 seconds, which I have used on many occasions, I could, by taking a mean of 5 sights, determine the sun's altitude, or the moon's apparent distance from the sun or a star to 10 seconds, or less.

Wishing you all the success which your various improvements richly merit,

I am, Sir,

&c. &c. &c.

JO. TAYLOR, *Chaplain of H. M. S. Spencer.*

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Reference to Mr. JAMES ALLAN'*s method of Cutting Mathematical Divisions, by which the concentric bounding circles are omitted,* Plate 10.

IN figures 1 and 2, *w w* is a sextant, in the act of being divided, it is laid on the upper surface of the dividing plate (part of which *a a* is shown), its centre coinciding with that of the dividing plate; *b* is the tangent screw, which, actuated by a cord and treadle in the usual way, and working in the teeth on the edge of the dividing plate, gives a definite motion to the latter at every descent of the treadle, equal to the required distance of the divisions on the sextant, which are marked by the conical pointed cutter *c*. This cutter is suspended in a sort of framing, which secures the true radial direction of the lines marked by it; and the motion of such framing, or elbow-joint as it is termed, is limited by mechanical means, so as to govern, without the application of the workman's eye, the different lengths of lines required to mark the values of the angles they comprehend, as degrees, or minutes, or any quantity of either. The apparatus for this purpose is suspended from a flat bar *d d*, lying across two long bars *e e*, elevated above the dividing plate at one end, by turned pillars, and resting at the other on a transverse bar. The several parts are detailed on a larger scale, that is, one-fourth the real size, in the remaining figures. Fig. 5 is an elevation of the elbow-joint, supposed to be taken looking from the left hand (see figs. 1 and 2) towards the sextant. Fig. 3 is a plan, or bird's-eye view of the same, in which the elbow-joint is concealed by the flat bar before described *d d*, which, it will be seen by the grooves and screws in its ends, has the power of being moved in the direction of the bars *e e*, to accommodate the point of the cutter to the varying radii

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of the instrument to be divided. Figs. 6, 7, 9, are sections of the elbow-joint taken on a line, which may be imagined to pass through the letters *i i*, in figs. 3 and 5, and looking in the same direction as in the elevation, fig. 1. Fig. 4 is a section taken on the line *y y*, fig. 5, and looking in the opposite direction. In fig. 5 it will be seen, that beneath the bar *d*, are suspended three separate pieces of the general form ⌐¬; the upper one is secured to the bar; the two lower ones are hung on screw pivots, so that the lowest has perfect facility of motion in the direction of the radius of the dividing plate, whether horizontal or otherwise, but not the least lateral shake. To the lowest are attached two arms *t t* (see figs. 5, 2, and 4), which meet in a point, at the extremity of which is fixed the cutter *c*. Fig. 10 represents the arms *t t*, and the cutter detached. These parts, comprising what is called the elbow-joint, are in common use, and by the action of the pivot-joints, permit a limited, but amply-sufficient extent of motion in the cutter. The lengths of the lines are governed in Mr. Allan's engine by means of various stops, which limit the swing of the middle portion of the elbow-joint; in fig. 1, this portion will be seen to have reached the limits of its motion towards the right, and in fig. 7, the section of it is described at its greatest recess towards the left; in fig. 4, *h* is the same thing, but not in section, as will be understood from referring to the line *y y* in fig. 5, which will be seen to cut only the upper piece of the elbow-joint, and that in the thinnest part, which will account for the different appearance exhibited in fig. 4, from that in the other sections. Against the sides of the upper piece of the elbow-joint, and at its left extremity, that is, immediately over the return of the middle portion, are fixed pieces *f* and *f*, one on each side; their forms are best identified in the darkly-shaded parts of figs. 7 and 9; in fig. 6, the lower part of

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the left-hand one is omitted, for the sake of leaving the other parts more distinct. Through the lower ends of the pieces *f f′*, pass two pins *g* and *g′* whose projections may be adjusted and fixed by thumb-screws, shown at *q*, in figs. 5 and 8. The pins *g* and *g′* limit only the extreme motion of the gimbals; the intermediate lengths are determined by puppets, *k* and *k′* passing through the lower ends of two inclined pieces, or tumblers *i* and *i′*. It must be mentioned, that although there are two tumblers *i*, and *i′* and two puppets *k* and *k′*, only one of each is in action at a time, and either may be removed out of the way of the elbow-joint; as those marked *i′* and *k′*, are seen to be, in all the figures, except fig. 9; with that exception, *i′* is described as greatly elevated, and retained by the pin *s*, which passes through it, and hangs it on to the bar *d*. The tumblers *i i′* slide up and down in staples, the lower staple to each tumbler being screwed to the pieces *f f′*, and the upper ones on the opposite edges of the bar *d* (see fig. 8). A pair of metal horns *m m* are attached to the elbow-joint for the purpose of stopping against the puppets *k k*,′ whose projections are adjusted and secured by thumb-screws *r*, as described, to the pins *g g′*; the inner extremities of *k k′* are notched, or stepped, so that as the horns *m m′*, which stop the gimbals for the short lines, are received above or below the diameter, the length of the line is greater or less, by exactly the depth of the notch, or step; the requisite elevations of the puppet *k*, for this purpose are given by two keys *n* and *o*, resembling flute keys, placed on the bar *d*, which play against the under side of the screw pin *l*, in the head of the tumbler *i*; pressing the key *n*, raises *k* to the height shown in fig. 6, while the key *o* would place it as shown by the dotted lines in the same figure; thus two lengths of lines are obtained; now let both keys drop, *k* will sink below the elbow-joint, as in fig. 7, and the elbow-joint will

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go on till it stops against the pin *g*, making a third length; but in order to permit this, an aperture is made in the tumbler *i*, immediately above the puppet *k*, through which the horn *m* passes (see figs. 7 and 8), the latter of which (fig. 8) represents one of the pieces *f*, and the tumbler *i*, with their pins, puppets, and thumb-screws as removed from their place in fig. 5, where the three screw-holes for attaching them may be seen. It must not be forgotten, that during this time, *i'* and *k'* have been wholly out of action; the motion of the elbow-joint to the right having been in every case stopped by the pin *g'*, because the lengths of the divisional marks are required to vary only on one side, which variations in the present case (dividing a sextant) are wanted on the side remote from the centre; but in dividing the nonius for the same instrument, the elongated ends of the lines must point towards the centre, to accomplish which, the pin *s* is taken out, the tumbler *i'* and puppet *k'* drop down, and the pin *p*, in the head of the former, falls upon the keys *n o*; the pin *l*, in the head of *i*, being previously withdrawn, the whole will appear in the state of fig. 9; *g* is now the permanent stop to the left, and the lengths to the right are governed by *i'* and *k'*, precisely as already described, in the other direction by *i* and *k*. The motion is given to the cutter, in either case, by the handle *v v*; and the uniform strength of the lines is secured by using any number of ring-weights, as *u*, figs. 4 and 10, with which the cutter is loaded, and which communicate all the requisite pressure. The advantages of these modes of acting on the cutter, namely, by the handle *v v*, and the ring weights *u u*, are, that the hand of the workman is removed to a considerable distance, and the risk of communicating a lateral pressure, or a tremulous motion to the cutter, wholly avoided. A piece of wire *x x*

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(see figs. 1 and 2) is suspended from the bars *e e*, and serves to rest the cutter in when out of action.

The pin *p*, in the head of the puppet *i'*, and the thumb-screws *q* and *r*, are omitted in some of the figures, to avoid confusion.

Reference to the Method of moving and stopping the Tangent Screw of Mr. ALLAN'S *Dividing Engine*, Plate XI.

FIGS. 1 and 2, *a a*, part of the dividing plate; *b*, the tangent screw which gives motion to it; *c c*, a sliding plate, which, acted on by the spring *d*, presses the tangent screw against the rack, on the edge of the dividing plate; *e e*, screws which fix the plate *c*, in the place to which the spring impels it, and prevent any unequal action of the spring. Before describing the manner of actuating the tangent screw, it will be requisite briefly to explain what is the defect in the old method, which this invention is intended to obviate; and the engraving here given will assist this object, as far as the parts of Mr. Allan's machinery correspond with those generally used. In figs. 1 and 2, a long axle, or mandril, is seen extending from *n* (a screw) at one end to *x* (a micrometer head) at the other; this axle, or mandril, is in two lengths, the different portions quite detached from, and moving independently of each other. The one part is a continuation of the tangent screw, and comprises all the parts from *h* to *x*; the other portion extends from *n* to *i*, and to this it is that the motion is first given from a treadle, attached to a line *q*, passing several times round the barrel *o*, and then returning to a counteracting weight, attached to the other end of the

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line *p*, after passing over a pulley (see fig. 7). By means of a ratchet wheel and click, when this part of the axle is moved, by depressing the treadle, it carries the part containing the screw round with it; but when it returns, by the action of the counter weight, the click slides over the teeth of the ratchet, and the tangent screw stands still. Certain contrivances are attached to the mandril *m m*, which stop its motion at certain points, and consequently regulate the quantity of revolution communicated to the tangent screw; but it will be evident, that although the mandril *m m* cannot go forward without carrying with it the tangent screw, the latter can proceed without the former; and this it is always inclined to do, in obedience to the impetus previously given to it, which the friction of the tangent screw will not in every case overcome. Hence arises an obvious source of error, which is avoided in the present contrivance, by placing the machinery (which stops the revolution of the mandril and the screw in their progress forward) in connection with the axle of the tangent screw itself.

Imagine now the part *m m* to be revolving, not by the descent of the treadle, but by the return of the counterweight, in which case the driving-wheel *l* will move from *k* towards *r*; the motion will consequently be from *r* to *k*, when the treadle descends, and when the tangent screw is moved. Revolving then from *k* towards *r*, and the screw *n* working in an upright, seen in fig. 2, the whole mandril must recede towards the left, till at last it has receded so far, that the head of the screw *r*, in the back of the driving-wheel, strikes against the sliding bar *u u*, which is attached to the main frame of the instrument, and which having grooves in it, may be made to change its position, and to permit any definite number of revolutions (limited only by the number of the threads in the screw *n*) to be made by the mandril

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m m, before the screw *r* shall come in contact with the end of the piece *u*, and stop what is here called the backward motion of the mandril, in distinction from the forward motion in which it carries with it the tangent screw. The movement, when the barrel *o* is impelled by the descent of the treadle, is communicated from *m m* to the tangent screw, by a pin *i*, called the driving pin, which takes into the ratchets of the wheel *h*; but it must be observed, that it is not merely necessary to limit the number of whole revolutions made; it is required most frequently to take portions of a turn, or any number of whole turns, and a certain portion of another, as a half, one-third, or two-thirds; therefore, three of the four teeth which are in the wheel *h*, divide it equally, and the fourth bisecting one of these divisions, the wheel is divided also into two. The wheel *f* has four pins, called stopping pins, projecting from its circumference, distributed exactly as the teeth in the wheel *h*, excepting that they are on the opposite halves of the wheel; or, for example, supposing that the pin which bisects one of the spaces formed by the other three, was at the extremity *f* (see fig. 1) of the horizontal diameter of the pin wheel, then the notch in the ratchet wheel, which in like manner bisects one of the spaces formed by the other three notches, would not be at *h*, but diametrically opposite, and for this reason, because the driving pin *i* always acts on the wheel *h*, at a tooth directly opposite to the stopping pin, which is made to terminate the motion of the screw forward. There is a piece *g*, partly concealed in figs. 1 and 2, and shown separately in fig. 8, which turns round a screw as a centre, has a spring *w*, which plays against one of its ends, and which has proceeding from its upper face (see fig. 2) two perpendicular projections, the right-hand one to receive and check the pins of the stopping wheel, the left-hand one (by means to be hereafter described) to cause the piece *g* to turn on

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its centre, and advance the stop at the proper period, under the pins of the stopping wheel. Fig. 5 shows the wheel which carries the driving pin detached; *i* is the driving pin attached to a piece moving on a centre, and retained in its place, that is, in contact with the ratchet wheel *h*, by a spring, which allows it to clear the teeth in returning; *k* is a snail screwed to the face, and projecting beyond the circumference of the wheel. As the wheel *l* advances to the right, by the action of the screw *n*, the snail *k* at last comes in contact with the left-hand projection, from the piece *g*, causes the latter to turn on its centre, and advances the other projection, or the stopping piece under one of the pins of the stopping wheel *f*; fig. 4 describes the snail and the piece *g* exactly in this state; fig. 3 shows them just previous to the commencement of the snail's action. Which of those four pins in the wheel *f* shall stop the motion, and by consequence how large a portion of a circle shall have been completed, whether a half, or one or two-thirds, or whether no fraction shall be included, is determined as follows: the screw *r*, in the back of the wheel *l*, which was described as limiting the returning motion of the mandril *m m*, is received into a hole, of which there are four in the wheel, and into either of which *r* may be inserted; these holes divide the circle like the stopping pins and ratchet teeth already described; they are shewn in fig. 7, *r*, *s*, *t*, and *v*, the screw being in *r*. It is evident that the alteration must be made by changing the situation of the screw in these holes, because the snail must necessarily finish its course in contact with the piece *g*, that is in the situation described in fig. 1 and in fig. 7; and in this latter figure it will be seen, that when the snail is so situated, the hole *v* has just cleared the piece *u*; if therefore the screw was in this hole, the mandril would make whole revolutions; if placed in *r*, it would add a third; if in *s*, a half; if in *t*, two-thirds; the value of these portions

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of the circle would, of course, depend on the fineness of the tangent screw; in this engine every revolution of the latter gives one quarter of a degree, one-third of a turn therefore gives five minutes. In fig. 6, the driving pin *i* is shown acting in one of the ratchet teeth, and the driving wheel *l*, and ratchet wheel *h*, appear attached together; this figure, however, only describes their relative positions; it will be recollected, that they are on different axles, though their axes are in the same straight line. The driving-pin *i* is of course required to be of a length somewhat greater than the whole extent of the lateral motion given to the mandril *m m*, by the screw *n*, or it would not retain its hold on the ratchet wheel.

The parts are drawn one-third the real size.

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PAPERS

IN

COLONIES AND TRADE.

UNDER this Class the Committee has thought proper to publish extracts from sundry letters received from Dr. Wallich, superintendent of the botanic garden of Calcutta. It will be perceived that the principal object in them is the naturalization in Europe of certain varieties of rice, which are at present objects of cultivation in Napal, and in other districts bordering on the Himalaya Mountains, and therefore subject during Winter to considerable degrees of cold. The Society of Arts having been liberally furnished with seed by Dr. Wallich, and desirous of concurring with that gentleman in his praiseworthy exertions for the public benefit, have distributed packets of the different seeds to several public establishments and individuals in the British islands, and also in France, in Switzerland, in Germany, and in Russia. The only report that has hitherto been received by the Society, concerning the result of experiments made with these seeds, is contained in the subjoined letter from Mr. Anderson, curator of the botanic garden at Chelsea, belonging to the Company of Apothecaries of London.

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Botanic Garden, Calcutta,
July 18th, 1819.

SIR;

I HAD the satisfaction to receive your favour of the 23rd December last, a short time ago, and I cannot better express the sense which I entertain of the honour conferred on me by your Society having elected me a corresponding member, in the room of my lamented friend and predecessor, the late Dr. Roxburgh, than by hastening to submit to their consideration the result of some inquiries directed towards a very interesting object of agriculture. I allude to a sort of mountain-rice, cultivated in Napal, at such elevations, and under such vicissitudes of climate, as to render it extremely probable that it may become acclimatized in the north of Europe. I received it during the last fortnight from Mr. Robert Stuart, resident at the court of the rajah of Katmandu, to whose indefatigable zeal and exertions this valuable discovery is entirely to be attributed. As all the information which I am able on this occasion to present to the Society is derived from his correspondence, I beg leave to subjoin some extracts of his letters to me on this subject, not doubting that I shall have it in my power, at some future period, to offer from the same source a more full account of the soil, temperature, and elevation of the countries where the grain is produced, and of the cultivation and nature of the plant itself. In the mean time I take the liberty to send you a sample of the rice, having previously satisfied myself of its goodness, by soaking some of it in standing water, during the operation of which process it began to sprout in less than three days from its immersion. I have likewise addressed several of my correspondents who are residing at Almorah, Sirinagur, and other countries contiguous to the Himalaya Mountains, on this important subject, and the information which I expect to derive from all those quarters, superadded to the prospects held out from Napal, will afford

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me ample matter for future communications, which I hope may not prove unacceptable to your Society, notwithstanding the unpromising results of the experiments which were made some years ago under the direction of Sir Joseph Banks with a similar sort of rice, obtained by Sir John Murray from Sirinagur.

In the course of another month I propose doing myself the pleasure of transmitting to you, for the purpose of being laid before the Society, a quantity of the common Napal paper, produced from the bark of some sorts of Daphne, described by me in the 13th Vol. of the Asiatic Researches, about to be published, together with a bale of the dried entire stems of *urtica tenacissima* of Roxburgh (caloe hemp) ,in order that they may, if it should be deemed fit by the Society, be submitted to the operation of the ingenious apparatus of Mr. Lee, and of Messrs. Hill and Bundy, adverted to in the 33rd Volume of their Transactions, and in the 8th, 9th, and 10th numbers of the Journal of Science and Arts.

I cannot conclude this address without requesting, that you will assure the Society, that nothing will ever contribute more to my happiness than to be able occasionally to afford my humble mite to the grand object contemplated by them, and that I shall exert myself to the utmost, with a view of submitting from time to time, such matters as I may hope will not prove altogether unworthy of their consideration.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. N. WALLICH, *Superintendent.*

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Extracts of Letters from Mr. ROBERT STUART, *resident at Napal, to Mr.* WALLICH, *Superintendent of the Botanic Garden, Calcutta, respecting Mountain Rice.*

June 13th.

THE minister has just sent me in a jar of grain, which he tells me grows on the Snowy mountains, by which I understand him to mean, the mountains beyond the northern barrier of the valley, not those covered with perpetual snow. I hasten to forward for your inspection a small parcel of this, and beg of you to let me know what you think of it. It resembles a species of rice; it certainly is raised in a pretty cold climate. As it has just come in, I have not had time to make minute inquiries regarding it; but if the information I may receive prove in any degree flattering, I will send you a good supply of it, together with all the particulars that I can collect.

June 19th.

I HASTEN to communicate to you the few particulars which I have learned regarding the mountain rice, a parcel of which was forwarded to you. It is cultivated in considerable abundance, I am told, among the mountains of Jumlah, which are situated to the northward of the province of Dotee; and it was introduced from that quarter a few years ago, and sown among our northern hills. That which I have procured, was brought from the Jageer of Devie Bhuggut, a distance of four days journey from Katmandu. The seed is first steeped for three days in jars of tank or rain water, and then removed into bags of gunny or matting, where it is kept in a moist state till it shows signs of vegetation, when it is sown in khets, previously prepared for the purpose. They lay some stress on the use of

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tank water, for steeping the grain in, alleging that the water of the mountain streams is too cold for the purpose; the same is to be used in occasionally sprinkling the grain to keep it moist in the bags. When they have once succeeded in raising it a few inches from the ground, they consider themselves secure of the crop, as a fall of snow does not then injure it. You will remark that this rice in the husk has a reddish tinge, which it preserves in some degree, I think, when boiled. It is large and fat; though sweet in taste, it is of so inferior a quality, that the people in this part of the country know little about it; and I have not even been able to learn from them the name given to it in the hills: the use of it, I fancy, is entirely confined to the inhabitants of them. It is, however, certainly worthy of attention, and I will not neglect any opportunity of getting more correct information regarding it. The minister has politely offered to procure for me a small quantity of it from the Jumlah Hills; and I am about to send some people to the hills above Gossain-Than, where both rice and wheat are cultivated, in order to see if there be any difference in the grain.

Botanic Garden,
September 2nd, 1819.

SIR;

In continuation of my letter of the 30th July, I have the honour to inform you, that the indefatigable exertions of the resident at Napal, Mr. Robert Stuart, have brought to light some further interesting particulars respecting several kinds of grain produced on the stupendous mountains of the Northern Hindoostan, which I hasten to submit to the Society, in the annexed extracts of the letters from that invaluable correspondent.

As it may be interesting to the Society to be furnished with some particulars respecting the place whence two of the

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sorts of rice, as well as the wheat, have been procured, I beg leave to submit to you the following account, which I received last year from my highly esteemed friend the hon. Edw. Gardner, late resident at the court of the rajah of Napal: "The general direction from Katmandu of Gossain-Than, or, as it is more commonly called, Neel-Khaunt, is very little to the westward of north. Ramcha, a village noted by Kirkpatrick in his account of Napal, is placed in his map almost at the foot of the Himalaya; and as Gossain-Than is said to be thirteen coss beyond, or to the northward (or N. E. perhaps) of Ramcha, it is inferred, that it must be situated within the snowy range; from which circumstance the height or elevation of that place may be tolerably well estimated. The distance from Katmandu, which is calculated at forty coss, it is to be remembered is not the horizontal, which does not probably exceed one-third; the remaining two-thirds, or something less, being allowed for the windings of the pathways, and the continual and very considerable ascents and descents, which constitute a road in these mountains. As an additional reason for supposing that Gossain-Than, is situated within the range of the Himalaya, it appears to be nearly on the route to Keeroo (one of the principal passes into Thibet), which place is to the north of the Snowy Mountains, and is usually reached by a traveller from Katmandu, I believe, in less than ten days, while it takes seven days to get to Gossain-Than, which would seem, therefore, to be about three days journey to the south of Keeroo, the probable distance of the Himalaya south of that place."

As soon as the rice which has been obtained from the fountain head, the mountains of Jumlah, arrives here, it shall directly be transmitted to you; in the mean time I have thought it my duty not to defer addressing you this letter, together with the later dispatches to which it refers, not

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doubting, that the highly meritorious and successful researches of my excellent friend Mr. Stuart, who has brought to light such important articles of introduction into the united kingdom, will meet with the approbation of the Society.

I take this opportunity of informing you, that I have sent a quantity of common Napal paper in bundles, each containing 100 sheets, in a chest of dried specimens of plants.

I am, Sir,

A. Aikin, Esq., &c. &c. &c.

Secretary, &c. &c. N. WALLICH.

Extracts from Mr. ROBERT STUART'*s Letters continued.*

July 11th, 1819.

I AM sorry that I cannot at this moment add to the information respecting the mountain rice; but I have taken means to procure what is necessary. It is little known to the inhabitants of the valley, and we labour under great disadvantages (in fact under great difficulty), in getting correct information regarding any thing beyond our reach; I hope, therefore, that you will not attribute the delay to any indifference on my part, either to the subject or your wishes, for I will take the earliest and the best opportunity of supplying what is wanting. That the rice is raised at a great elevation, in spots covered during some months with snow, I cannot doubt; and that it grows in spite of snow appears probable from the foregoing circumstances. I mentioned, I think, in my former letter, that the precarious part of the cultivation is in raising it from the ground, lest frost and snow should arrest and destroy it; but that all anxiety is at an end, when it has fairly risen two or three inches high. A small quantity which I planted in our garden by way of experiment, has sprung up rapidly. I

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have just transplanted it, and will see what sort of grain it will yield.

July 16th.

SINCE my last letter, forwarded on the 11th, I have had the pleasure to receive your letter dated the 1st and 2nd instant, with a paper containing an account of the experiments made in England, on the rice from Sirinagur. With regard to this subject, it appears to me, that the hopes entertained of success were too sanguine. Sirinagur, though certainly an elevated and cold climate, compared with Hindoostan, is still but the threshold to these countries, and cannot be spoken of in the same terms as the mountains of Hindoostan, called Jumlah, which form part of the continuous snowy range, or even to the spot from which the rice forwarded to you was procured. It is probable therefore, that the grain of the one may differ essentially from that of the other. I have no doubt of the accuracy of the account given to me, that it is raised on the elevated and snowy tracts alluded to; but in case of any mistake, or for fear the grain introduced into a milder climate should degenerate, the minister has promised to procure me some from Jumlah; but owing to the distance and the season, some time must necessarily elapse before I can receive it. Be assured I shall not relax from my endeavours to sift this question thoroughly, so that the fairest trial for the introduction of that grain to England may be given it.

July 21st.

I TOLD you I had sent an exploring party to Gossain-Than, and had given them orders to inquire, and procure some of the rice cultivated in that quarter, and also specimens of it in flower and grain. Two of the boys returned yesterday,

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with some young pines and other plants, and said the hill rice was not yet above a foot and a half above the ground. They are, however, instructed to procure it, as well as the wheat raised by the Bhooteahs, which is represented to be different from any known here. You shall be informed of the result.

August 2nd.

I HOPE in time, to gain more satisfactory accounts respecting this interesting article, and, at the same time, some fresh grain from the fountain-head, viz, the Jumlah Mountains. These seem to be a continuation of the snowy range, and are subsequently lost in the lower mountains of Dootee. By the account of the natives, they are perpetually covered with snow. They are laid down in the best maps between the 29th and 30th degrees of latitude, whereas Sirinagur lies somewhat above the line of 30. But the elevation of the former must be much greater, I imagine, than the latter, and the climate vastly different; at all events, the trial is very well worth making. My people have returned from Gossain-Than, and have brought me small quantities of three different sorts of grain, two of rice, and one of wheat, raised in that quarter. No. 1 is the rice (mountain rice) formerly sent to you. No. 2 is rice from Gossain Than, which is sown in the month of July, and must consequently be subject to cold, if not to frost or snow, before it can come to perfection. No. 3 is rice from Gossain-Than, which is sown in the month of May. The rice khets (or fields) are made on the sides of the hills, partly in level spots, partly in terraces, and of course abundantly watered from above. No. 4 is wheat from Gossain-Than, which is about to be sown the end of this or the beginning of next month. It remains in the ground ten months, and is cut and collected in Jeth and Assar, that is in June. It remains stationary (or

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its progress is scarcely perceptible), during the frosts; it springs up with the Spring, and comes to maturity in the warm months. This is the account given to me by the people, and I give it to you in the same terms. It is of course imperfect, but it is the best procurable in our situation, and we must make the most of it.

August 17th.

The minister has not forgotten his promise to gratify me with specimens and supplies of rice from Jumlah; and I really think, from what I learn, we may be sanguine in our hopes of doing something with this supply, even should that which I before sent you fail. There are two kinds, and both different from that which I originally forwarded to you. I inclose a small portion of each, in order that you may distinguish the kinds, on the receipt of the boxes which I shall hereafter send to you. I have an immense quantity of it, and only wish I could provide you by wholesale. No. 1 is called Kala Marsee, and No. 2, Munsurra.

The former is esteemed the best rice, and is called the "Usl," or original grain of those hills. It attains a great bulk in the process of boiling, and is considered sweet and excellent by the natives.

No. 2 is also rice of a good quality and colour; they both came from Jumlah; where, as I before observed, the hill rice is cultivated in elevated and exposed situations. The soil is spoken of as inferior to that of the valley, but still rich. The cold is sufficiently indicated, by the summits of the mountains being, I believe, perpetually covered with snow. I could learn no difference in the mode of preparing the khets, from that observed in this quarter; and in the general mode of cultivation, I have nothing to add to what I before communicated. The precaution of steeping the seed in standing

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water, untill it commences to germinate, is still insisted on, and they repeat that, if you succeed in raising the plants a few inches from the ground, no injury is to be apprehended from frost or snow.

N. WALLICH.

Botanic Garden, Calcutta,
December 29th, 1819.

SIR;

I HAVE great satisfaction in announcing that my friend Lieut. W. N. Forbes proceeding to England on the Boyne, has been so obliging as to take charge of three sorts of rice from Gossain-Than, in Napal, a place of vast elevation, and the most rigorous Winter. There are three sorts or varieties, respecting which, however, I have hitherto not procured any information, except that the dark-husked grain is called Dhan Mooya; the palest sort Dhan Mokya, and that which is the intermediate in colour Dhan Sittara.

Secondly, specimens of five sorts of Daphne paper, manufactured in the vicinity of Katmandu, communicated by my indefatigable friend Mr. Robert Stuart, from whom I have also received the preceding grains.

Thirdly, specimens of Daphne paper, which have been sent to me by my highly esteemed friend Sir Robert Colquhoun, from the province of Dhotee, to the eastward of Kemaon, where he is in command of the provincial battalion.

Fourthly, some papers of recent Sirinagur onion-seed,* also communicated by Sir Robert Colquhoun. Their produce is of a very large size, and superior flavour.

Fifthly, at the top of this box, as also occupying the whole of box No. 3, a number of panicles of a very interesting sort of Guinea-grass (*Andropogon cernuum* of Roxburgh—*Sorghum* of Willdenow), with perfectly ripe seed, which were produced

* This seed has not been received by the Society.

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this month in my garden, from a number of plants, reared from seeds in January of this year, which I had received from my valuable assistant at Sylhel, the late Mr. M. R. Smith. In order to put you in possession of the best information I can possibly procure on this subject, I do myself the pleasure to give you the following extract from the manuscript *Flora Indica*, of Dr. Roxburgh :—

"This species or variety of sorghum, is the kind cultivated by the inhabitants of the Monipare, Karhee, &c. mountainous districts, immediately east of Bengal. The grain is milk-white; some of it was sown in the Botanic-garden at Calcutta, in the early part of the rainy season of 1812, and by November the plants were from ten to fifteen feet high, with several ramous stems from the same root or grain of seed; all the joints of the lower half of the original stems, which are as thick as a slender walking cane, throw out copiously verticils of roots; the lower ones, near the soil, enter it, and give additional support and nourishment to the plants, which are of two or more years duration, if suffered to remain. The leaves are from twenty to forty inches long, by two to three broad, soft and smooth. The grain is the staff of life of those wild savage mountaineers, who inhabit the above-mentioned countries, where it is one of the few articles cultivated by them; cattle are fond of the straw, or rather canes."

Three large bales, containing entire stems of the calooe hemp, noticed in my former letters, will be shipped by order of government, on the Hon. Com. Ship Carnatic, about to leave this port in a fortnight hence, when I shall have the pleasure to address you more fully on this matter.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. N. WALLICH.

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Botanic Garden, Calcutta,
January 20th, 1820.

SIR;

I HAVE now the satisfaction of informing you, that the calooe hemp alluded to in several of my preceding letters, has been embarked in three large bales, by permission of government, on the Hon. Com. Ship Carnatic, which will leave Saugur Road in a couple of days.

Bales No. 1 and 2 contain each 2,500 entire stems of the calooe hemp-plant, (*Urtica tenacissima*, of Roxburgh—*Nivea* of Willdenow—*Rameum majus* of Rumphius), cut during the month of July last.

Bale No. 3 contains the bark peeled off 300 entire recent stems, immediately after being cut in July last. I have likewise added in this bale about 200 entire stems of Roxburgh's *urtica pulcherrima*, a charming large shrub, or rather small tree, of very rapid growth and easy cultivation. Although the fibre of this nettle is far less strong than that of the other, yet, I have thought it not entirely unworthy of being brought to the notice of your Society, especially on account of the two last-mentioned properties, which it possesses in a very eminent degree, those of rapid growth and easy cultivation. The various interesting papers on the calooe hemp, published by the late Dr. Roxburgh, have so completely exhausted the subject of its cultivation and management, as to render it entirely unnecessary to trouble you with any detail in these respects. I shall, therefore, conclude by saying, that Captain Blanchard, of the Carnatic, has most politely taken charge of a small package, containing specimens of a superior sort of Daphne, or Set Burrooa paper, manufactured at Lohoo Ghaut, in Kali-Kumaon, to the eastward of Almorah, by a jamadahr of captain M'Harg's battalion. They were sent to me by my friend Sir Robert Colquhoun, who commands at Al-

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morah. In the hope that these dispatches may reach you in safety, and prove acceptable to the Society,

I am, Sir,

A. Aikin, Esq., &c. &c. &c.
Secretary, &c. &c. W. WALLICH.

Botanic Garden, April 15th, 1820.

SIR;

I BEG leave to inclose a bill of lading for a small box of Mountain rice, supposed to be from Gossain-Than, in Napal, (proceeding on the Essex, Capt. Mahon.) The greater proportion below is called Hewjahkeewah, that above Hakoomarsewa. It was sent to me with a quantity of other sorts of rice, by my late friend Mr. R. Stuart, whose unexpected and untimely death it is now my mournful duty to announce to the Society. In that excellent young man this garden has lost a most valuable friend and contributor; and if, as I most anxiously hope, some of the dispatches of cereal grains, which I have had the honour of presenting to you since July last year, should be found of any value, it is to the unremitting zeal and attention of my lamented friend that I feel indebted for such a success. It is, however, a source of great satisfaction to me, to be able to assure the Society, that my excellent friend, the honourable Edward Gardner, the resident at Napal (having lately returned to Katmandu) will feel happy and proud to promote the objects in view as much as it is in his power; and I take this opportunity of earnestly requesting that I may be honoured for that purpose with the specific desiderata of the Society; the more so as I am preparing for a voyage up to that highly interesting country.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.
Secretary, &c. &c. N. WALLICH.

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Botanic Garden, Chelsea,
Nov 6th, 1821.

SIR;

THE packets of Napaul Corn-seeds you were pleased to send me for trial last November, have produce a very pitiful return, but this in some measure may be ascribd to the very cloudy Summer we have had. In Mareh we vegtated the five sorts of rice, all very well, except Jurmassee; of this there were only three plants succeeded. We followed yur directions with one part of the seeds, and sowed the other art in pots, placed in pans of water; and it was in your wy that Jurmassee vegetated: probably in that way debilitsd seeds are less exposed to corruptive matter, than when pt into the earth at first. I intend to try small seeds this wy, as well as in pure sand, with little moisture, as I am sured, that old seeds coming in contact with putrid bodies in he mould, perish when the vegetating power is too faint to resist the contagious matter. The Andropogon is a large tut of grass, but does not yet show flowers. The wheat has producd very good seeds, but not to be compared with the wrst of the cultivated sorts; but we expect a better return ext year, having sowed these new seeds as they ripened lat month. The rices did all very well while they remained in hothouse heat; in May we placed them in the green-houe where they became stout healthy plants; and in the end of June we planted five sorts in a well-sheltered bason of nine iches of water, and 12 of mud, where the Zizania, or Canalian rice thrives well: the four other parts we planted in a bog.

Those in the water grew, and promised well, till th beginning of August, when the weather became cloudy and cold; soon after that, they gradually became yellowish and sickly, and were all dead by the beginning of September those planted in the bog never looked healthy; thence I suppose

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the water to be the more steady temperature, from its greater power of attracting and retaining the daily influences of the sun.

To the above I must add, that I have made many trials of rice seeds from America, China, and Persia, but never succeeded with any but one, brought from the higher parts of the river Missouri, in N. W. America, by Mr. T. Nuttall, in 1816. The two warm Summers of 1817 and 1818, had raised a hope of consigning it to the attention of the farmer; but this expectation was blasted when at its height, for in 1819 the harvest was so bad, that we just saved seeds sufficient to sow in 1820 when it totally failed.

I take the liberty of sending you a pot of a species sent me this last Spring from Moscow, where, if I understand Dr. Fischer aright, it is cultivated as a corn; but I did not try it in the open ground this year; and if I have better success next year, I shall be happy in communicating the result.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Secretary, &c. &c. WILLIAM ANDERSON.

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SUPPLEMENT.

MR. NAPIER'S TRACING INSTRUMENT.

A DESCRIPTION and figure of Mr. Napier's Tracing Instrument are inserted in the 37th Vol. of the Society's Transactions, p. 63. On examining the description there given, some inaccuracies have been detected, the correction of which, in the opinion of the Committee, would be more satisfactorily made, by re-publishing the description so amended, than by a mere list of *corrigenda*.

[The reader is requested to correct a trifling error in the engraving of the instrument: the screw under fig. 10 is by mistake called *h*, instead of *p*, to which it may be easily altered with a pen; it will then agree with the other parts of the engraving, and with the references in the description.]

This instrument, which is intended for making copies of drawings, or prints, either direct, or in reverse, is described [see Plate 5, Vol. 37] in a plan, fig. 1, and an edge view, fig. 2, remarking, that in the former, it is prepared for making a direct, and in the latter, for a reverse tracing of the drawing, or print. It consists of a flat board, or frame B C D E, fig. 1, divided by a cross-bar X, into two portions, one of them, A, to receive the original, and the other, F, to contain the paper

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for the copy. When, however, the tracing is to be the reverse of the original, the paper is fixed by the sliding springs M M, to the underside of the frame H I K L, fig. 1, or H I, fig. 2, which falls turning on the joints at B and E, immediately over the portion F, of the larger frame; the end I K, supported by two screw-pins *i i*, to which, by means of nuts, may be given any requisite degree of elevation; the joints on which the frame H I K L turns, may also be depressed, or elevated by similar screws and nuts *i i i* (see the extremity H, fig. 2); at H and I are seen two of the nuts and screws, which bind the ends of the springs M M, to the frame H I, which latter, when not in use, falls back at a small angle from the perpendicular, and is therefore drawn foreshortened at H I K L, fig. 1.

The tracing instrument consists of two long arms N N, O O, and four shorter, P, Q, R, S, forming together the two parallelograms N O R S, and N O P Q, the parts comprised in the latter, divided by equidistant holes, to admit the alteration of its points of motion, and consequently to vary at pleasure the proportions between the original and the tracing. Near the intersection of the arms R S is fixed the handle *g*, by which the blunt-pointed pin *d* (shown also at *d h*, figs. 2 and 5) is guided over the lines of the drawing, or print. The pin *d* is not however fixed to the arms R S, or to the handle, but moves freely up and down in a tube placed at the junction of the limbs of the parallelogram, and forming the axis round which they move; this tube is described in section at fig. 5, together with the piece projecting from its lower extremity, to which is applied, by a universal joint, the handle *g*. The pin is limited in its motion downwards, by its head *c*, and upwards by the small cross pin *h*, and it is kept down to the paper by the spring *f*, attached to the limb R.

This spring, with a gentle and equable pressure, preserves

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the point in contact with the original drawing, notwithstanding the various degrees of elevation which are occasionally required to be given to the limbs of the parallelograms, either for maintaining the action, or the marking-pen or pencil *c*, or for overcoming any irregularities in the surface of the paper. The use of the spring will appear more evident, from considering, that in using the instrument, as in fig. 1, for direct tracing, the hand of the artist must communicate to the hither parallelogram a tendency to rise, in order that the marker at the opposite extremity may be kept applied to the paper; but while in use for reverse tracing, as in fig. 2, a contrary tendency must be produced; and it is plain, that without the intervention of the spring, the point *d* could not, under both circumstances, be maintained in contact with the original. When it is required to pass from one part of the paper to another without marking, the handle need merely be acted on in a contrary direction, and the marker is immediately relieved. The pen or pencil is placed in a tube *c*, similar to that containing the pin *d*.

The joint placed beneath the intersection of, and supporting the two parallelograms, is constructed so as to allow the greatest facility of motion in all directions; it is shown in a plan, fig. 3, and a section, fig. 4, and its constituent parts are detailed in figs. 9, 10, 11, 12, and 13. The pieces figs. 9 and 13, stand at right angles to each other, and on opposite sides of the ring, fig. 12; and the return ends at *l m u v* being perforated, are applied by the screws T U V W to the ends of the radial arms *q*, *r*, *s*, *t*, fig. 12, the latter having concavities to receive the conical points of the screws, and thus forming altogether a universal joint; *n*, in figs. 4 and 10, is a spring, of which there are two, standing also at right angles to each other, the middle of the convex side of each spring, bearing against the centres of the pieces *l m* and *u v*,

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figs. 9 and 13, respectively, while the extremities of the springs play against the four cylindrical arms *q r s t*, radiating from the ring, fig. 12; these springs, by keeping the parts of the joint in a state of tension, prevent any shake in the centres of motion, and cause the instrument, when unbiassed by an extraneous force, to assume a horizontal position. In fig. 14, X is the cross bar of the main frame of the instrument; Y and Z are the nut and screw, by which the lower portion of the joint (the piece fig. 13) is clamped to it. N N and O O, fig. 8, are an edge view and plan of the central portion of the limbs, bearing the same letters in fig. 1, and to these are secured by the screws *k* and *p*, both received into one nut the piece fig. 9, which forms the upper portion of the joint; *w*, in fig. 4, is the section of the piece fig. 13; and immediately between the shoulder of the screw *p* and the piece *l m* is seen the section of the uppermost spring, nearly cut through, by the perforation for the screw *p*.

Figs. 6 and 7 represent the two moveable joints at *a b*, *a b*, fig. 1, which permit the alteration of the size of the parallelogram, N O P Q, together with the screws, which passing through the holes in the limbs, retain them in their places but allow perfect freedom of motion round them as centres.

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MR. HARDY'S TIME-KEEPER.

In the last Volume will be found a very detailed account of the Escapement, Train, and Pendulum of Mr. Hardy's Time-keeper, for which the large Gold Medal and Fifty Guineas were voted to him in the Session 1819-20. The subjoined account of the rate of going of two of Mr. Hardy's Clocks, one at the Royal Observatory Greenwich, the other at the Royal Military College, Sandhurst, will no doubt be both interesting and satisfactory.

Royal Observatory.

1820				1820		
Apr.	22, 25	1″.4	—	Aug.	26	1″.4	—
	29	0.9	—		28	1.4	—
May	4	1.1	—	Sept.	2	0.9	—
	9	1.1	—		7	1.2	—
	12	1.0	—		12	1.3	—
	15	1.0	—		18	1.3	—
	19	0.9	—		29	1.0	—
	23	1.3	—	Oct.	3	1.0	—
	27	0.9	—		6	0.7	—
June	12	0.9	—		12	1.1	—
	25	0.9	—		17	0.8	—
	27	0.9	—		24	0.7	—
July	1	1.3	—		28	0.7	—
	6	1.2	—		30	0.7	—
	11	1.0	—	Nov.	2	0.9	—
	17	0.9	—		14	0.9	—
	24	1.1	—		17	0.8	—
	30	1.2	—	Dec.	7	0.9	—
Aug.	4	1.1	—		28	0.8	—
	8	1.4	—	1821			
	13	1.3	—	Jan.	29	0.5	—
	18	1.1	—	Mar.	15	0.5	—
	22	0.9	—	Apr.	9	0.6	—

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Royal Military College, Sandhurst.

1820			
Feb.	17	0.6	+
	28	0.8	+
Mar.	1	1.0	+
	5	1.1	+
	8	0.9	+
	15	0.6	+
	30	0.5	+
April	5	0.4	+
	11	0.6	+
	20	0.3	+
	28	0.	
May	5	0.2	+
	11	0.1	+
	21	0.1	+
	29	0.2	+
June	7	0.1	+
	12	0.2	+
	15	0.2	+

1820.			
June	23	0.	
July	10	0.1	—
	17	0.2	—
	23	0.	
	27	0.2	—
Aug.	1	0.1	+
	10	0.2	+
Sept.	1	0.3	+
	21	0.7	+
Oct.	3	0.7	+
	17	0.8	+
	26	1.1	+
Nov.	1	0.9	+
	4	1.1	+
	16	0.9	+
	23	0.8	+
Dec.	13	1.0	+

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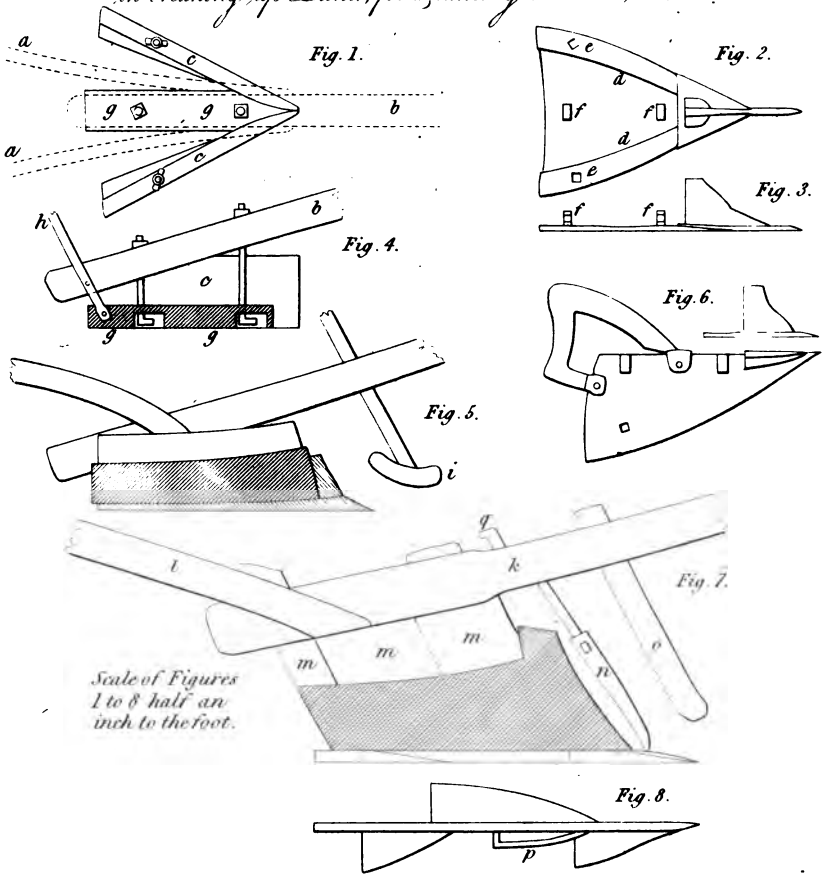

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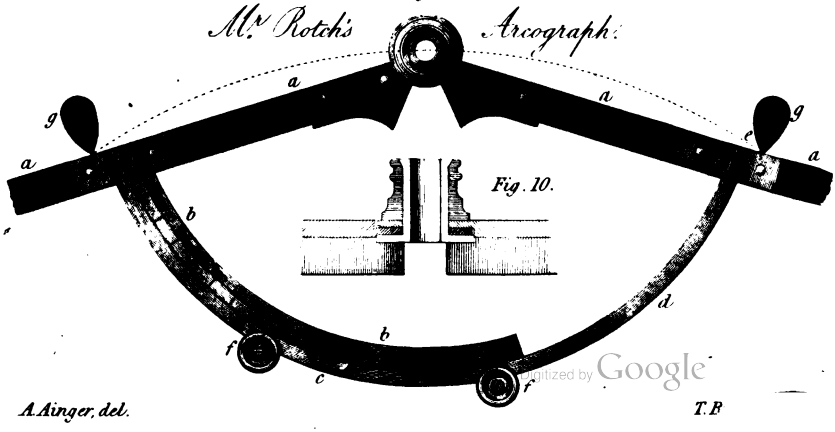

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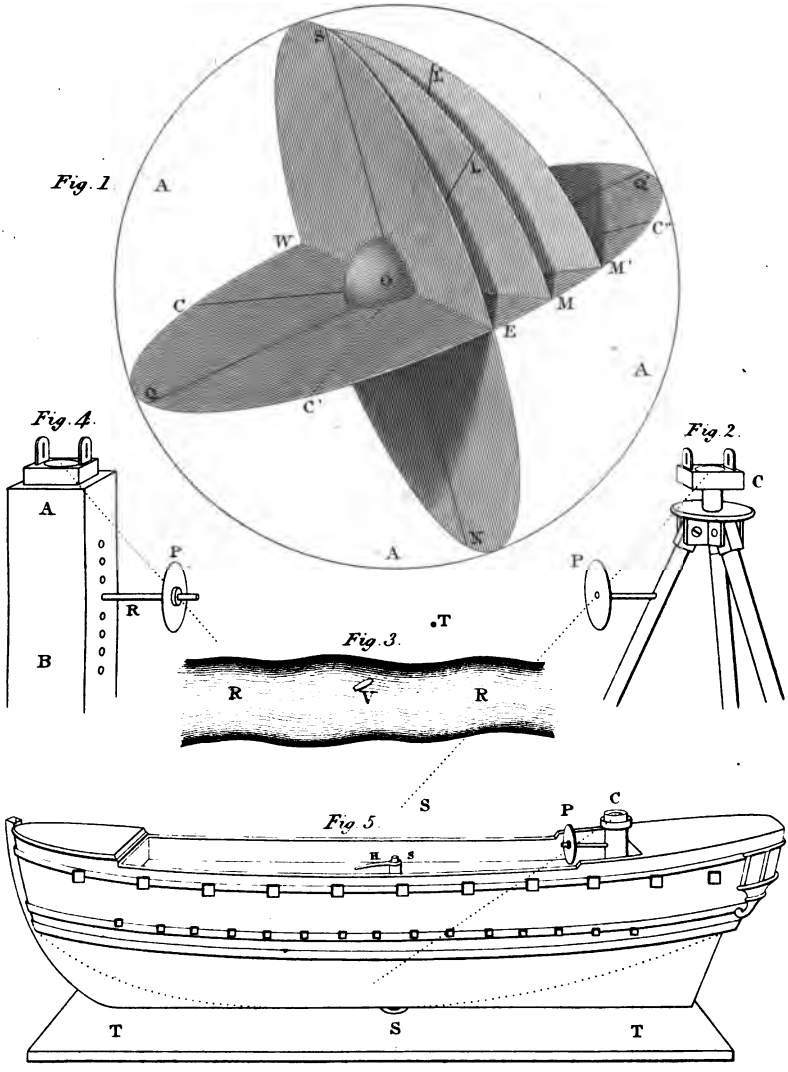

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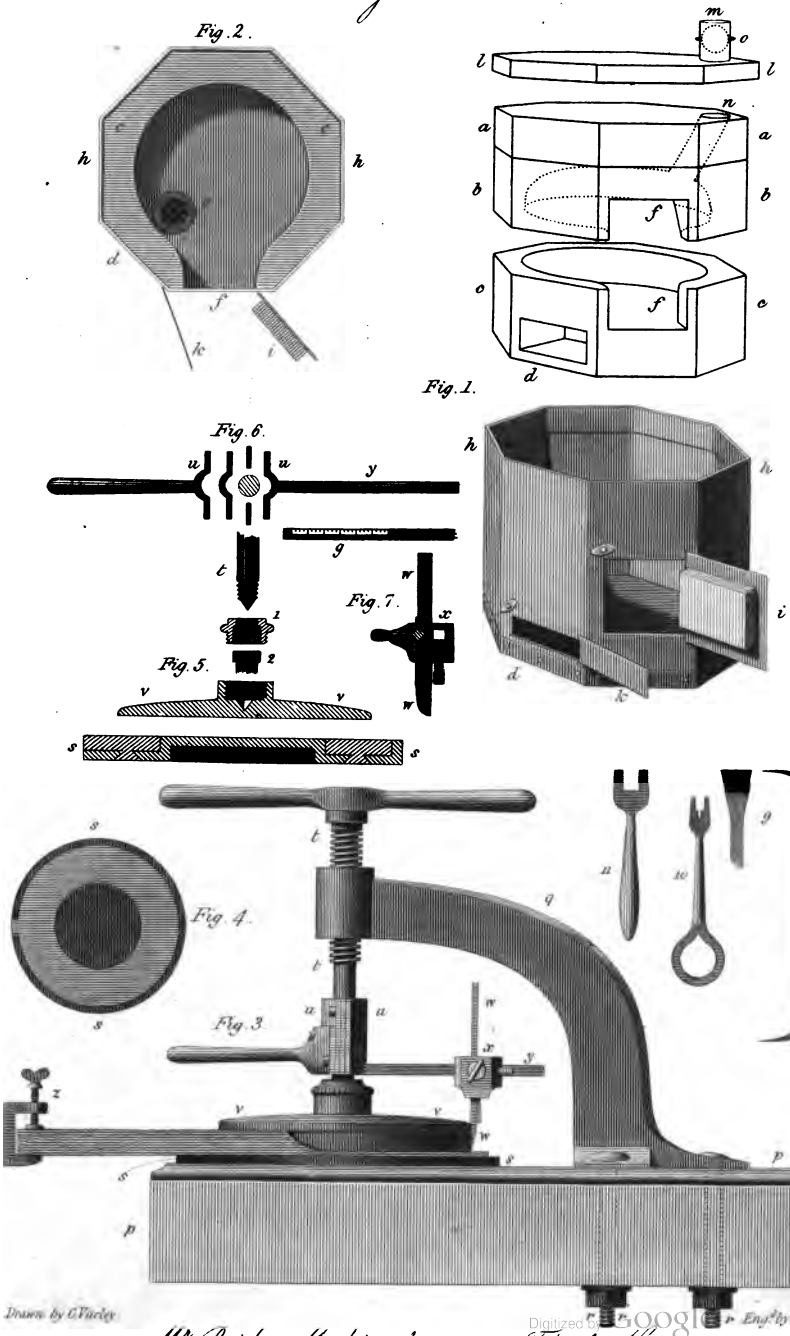

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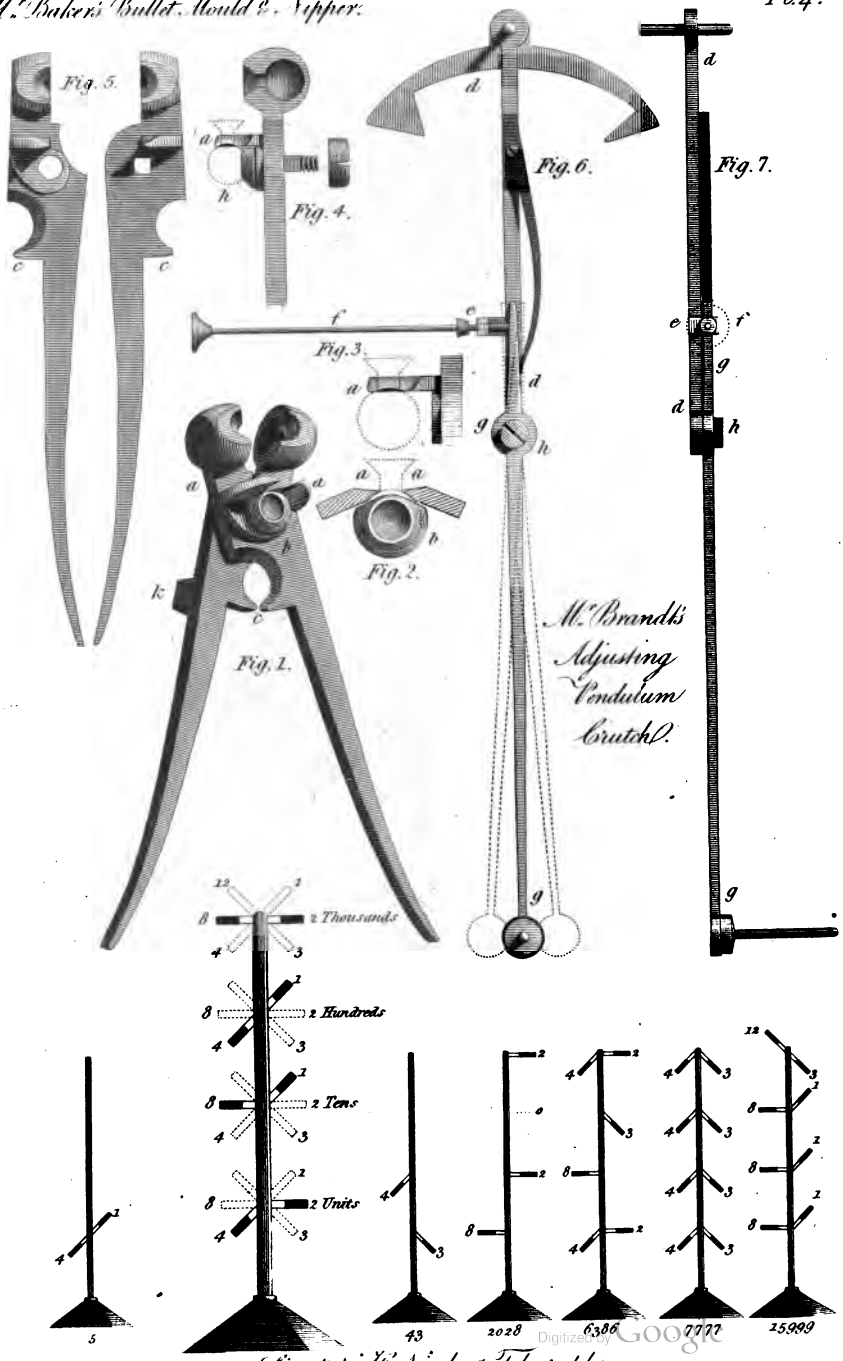

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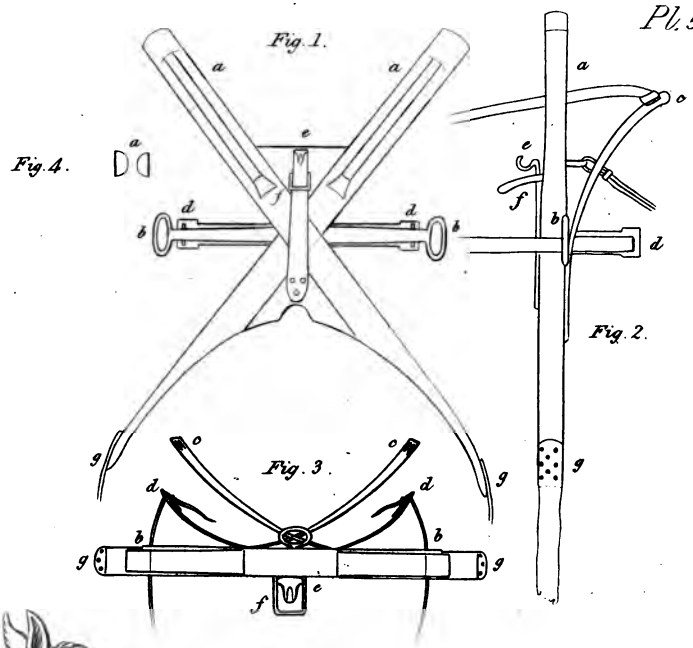

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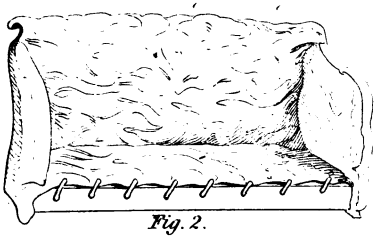

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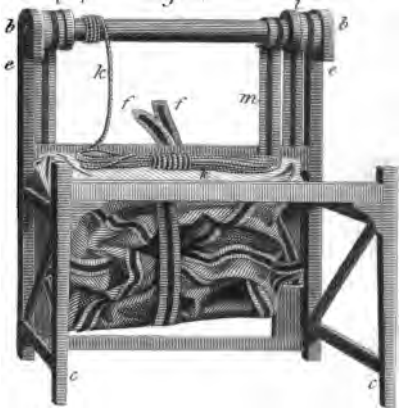

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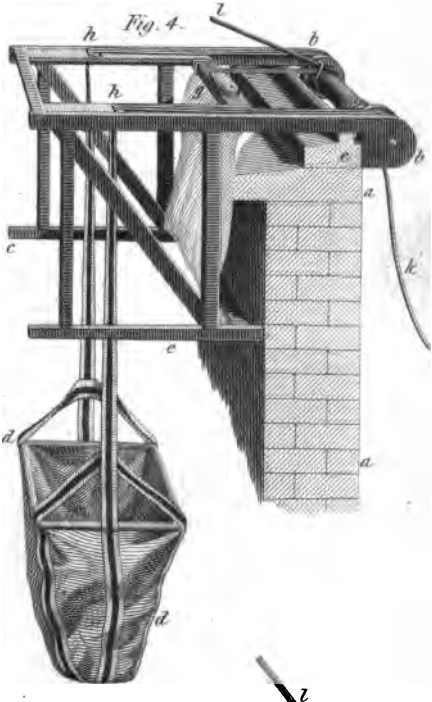

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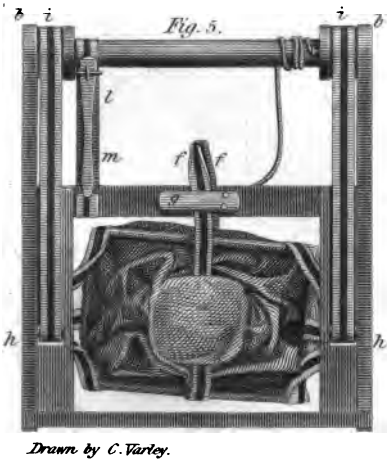

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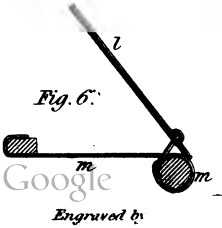

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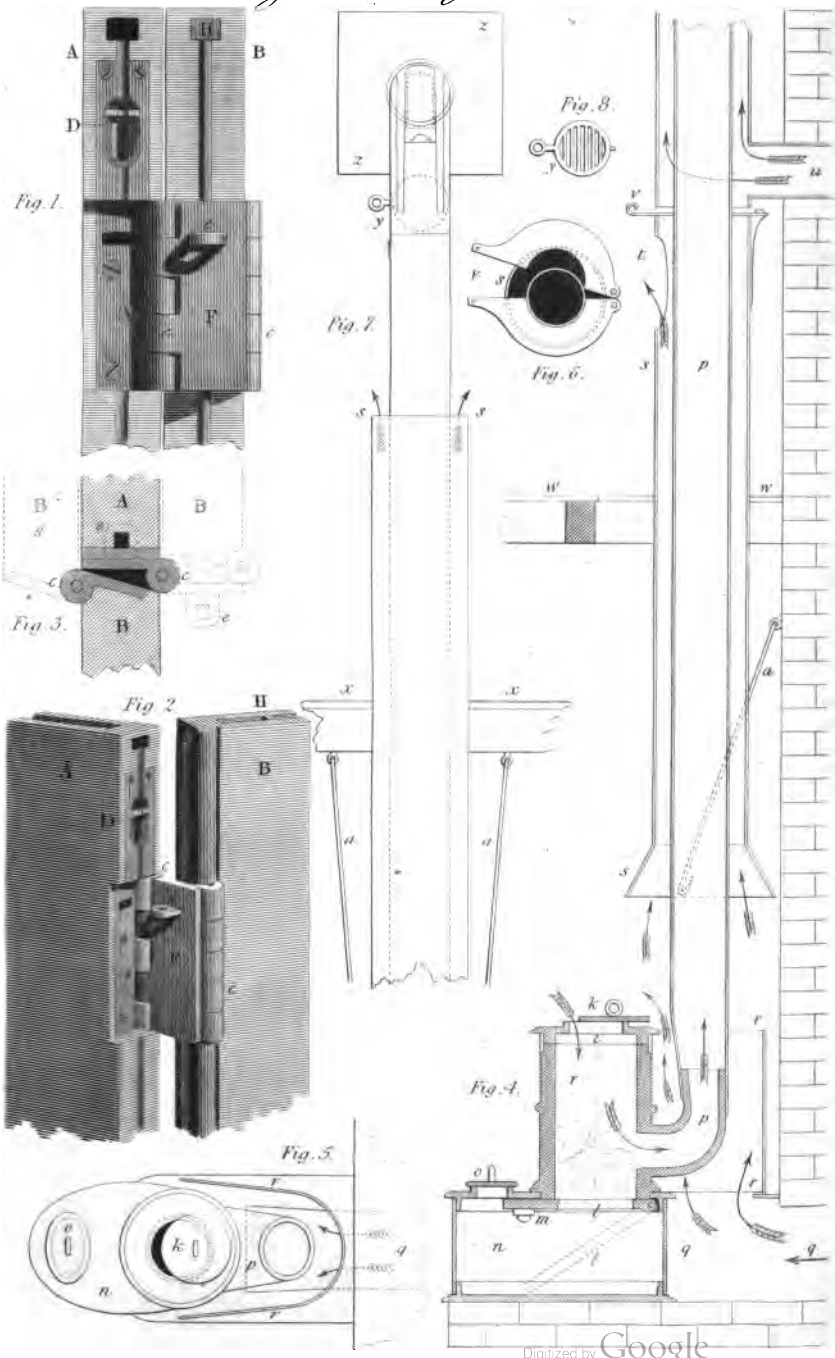

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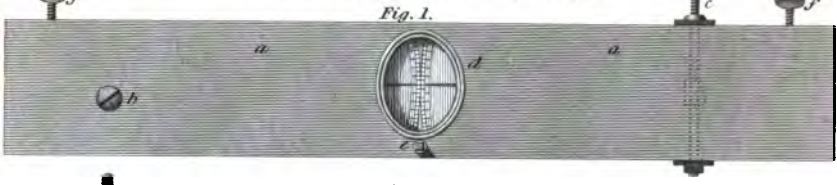

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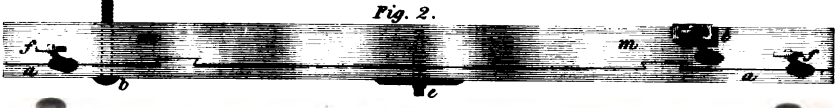

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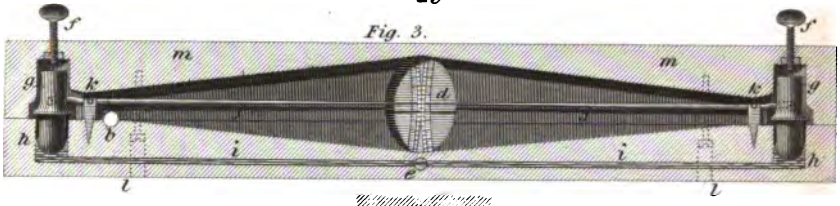

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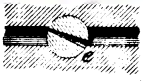

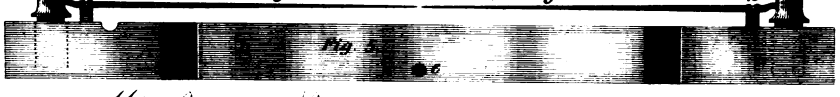

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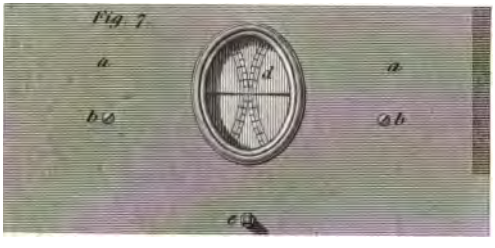

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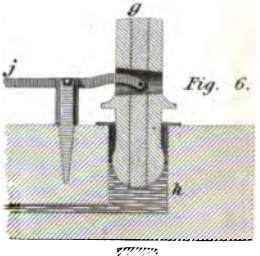

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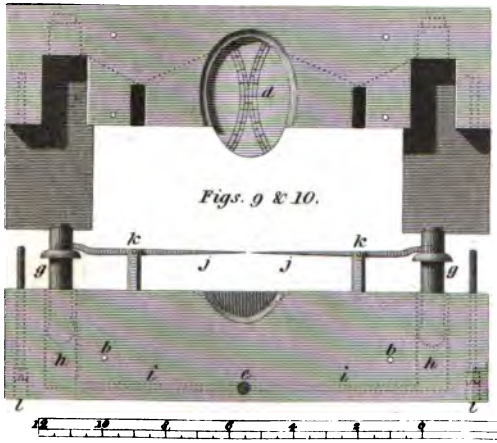

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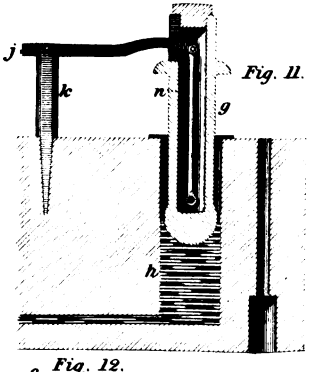

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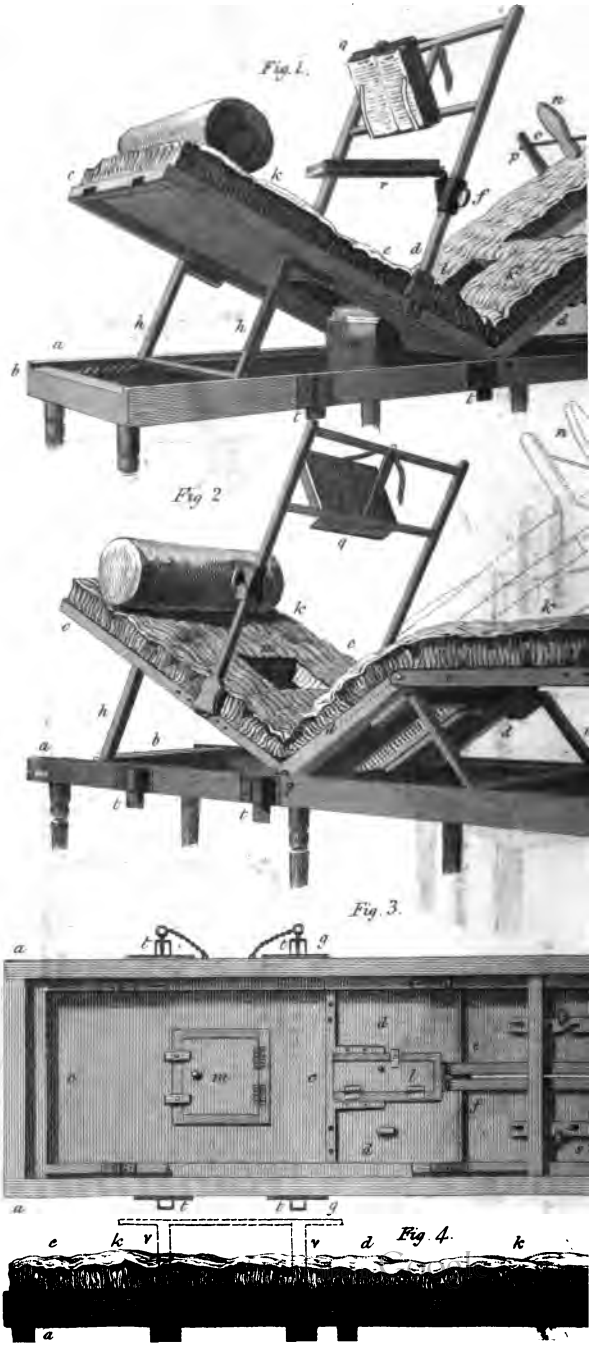

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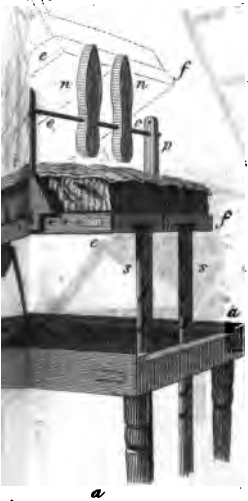

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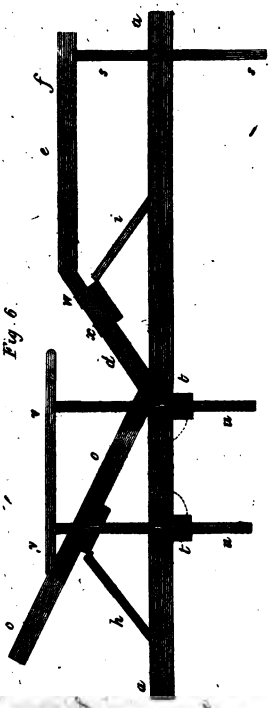

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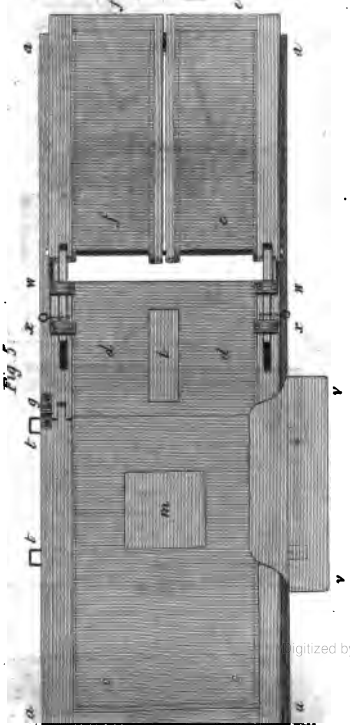

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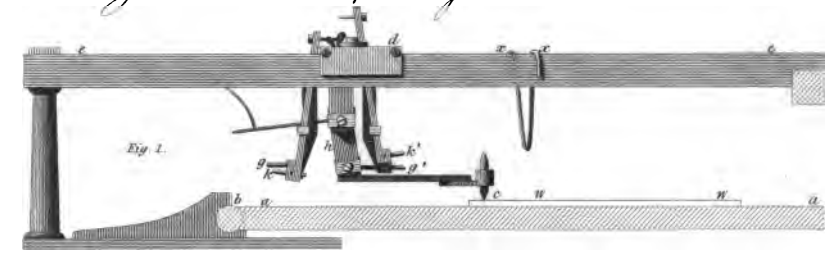

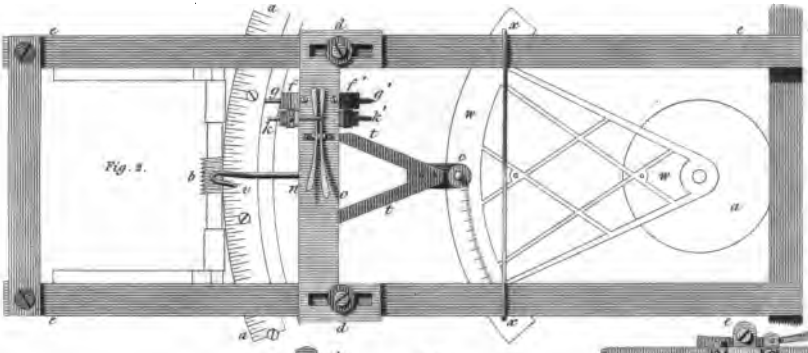

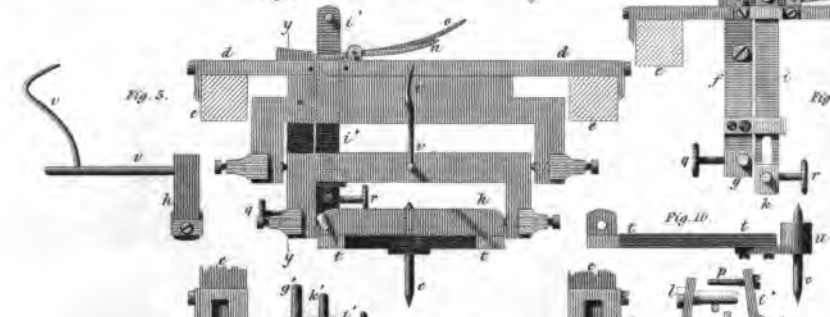

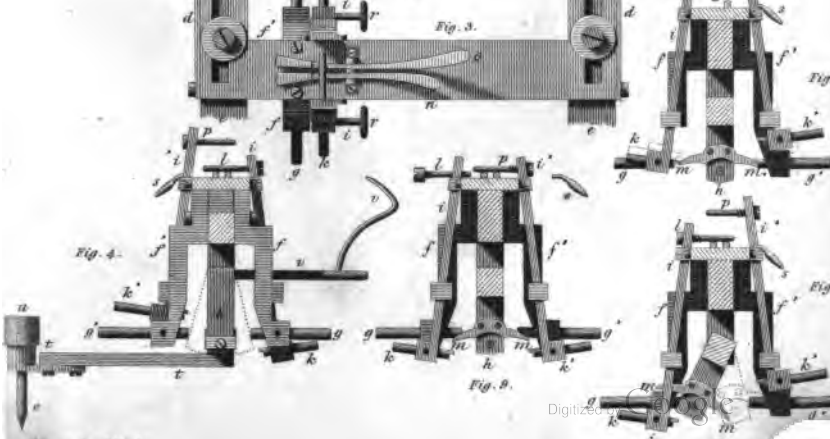

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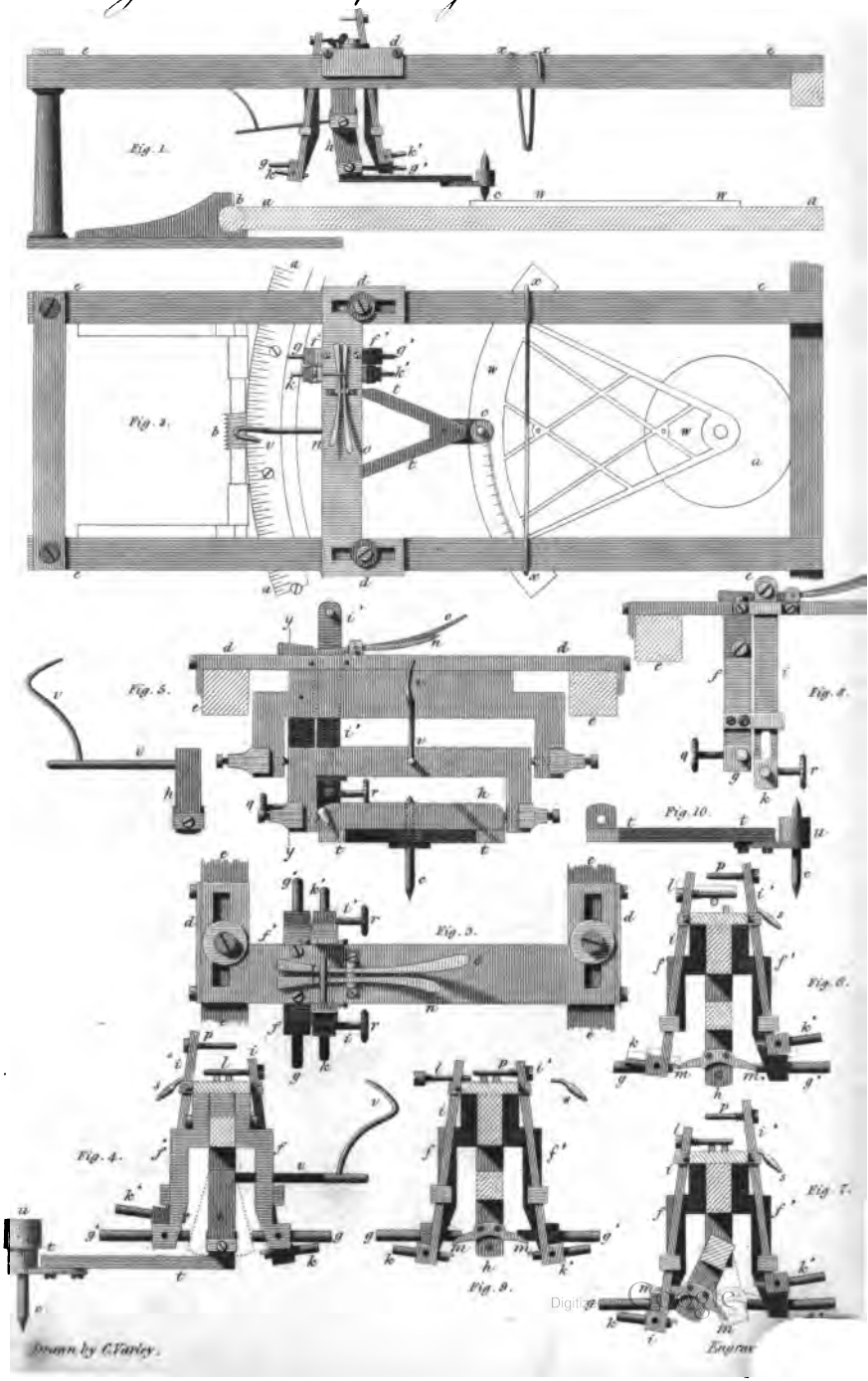

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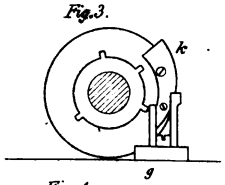

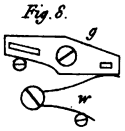

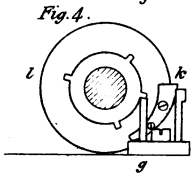

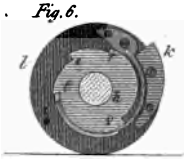

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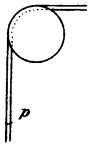

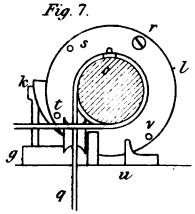

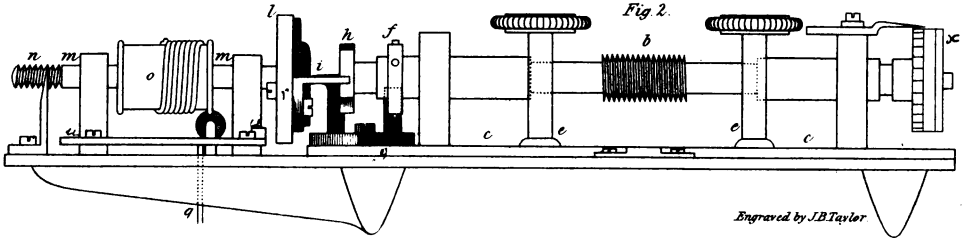

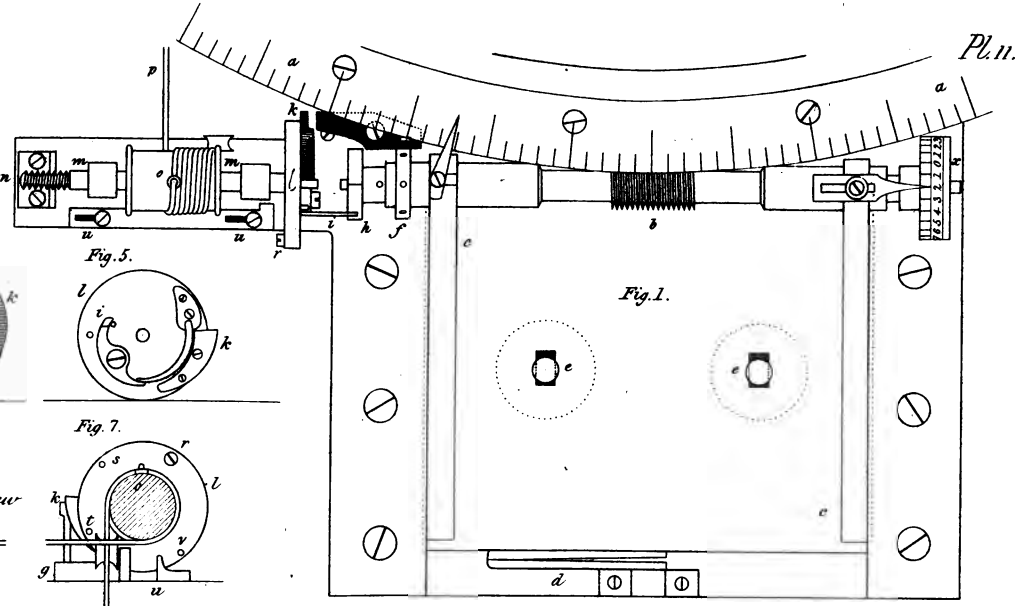

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Lieut. N. H. Nicolas's Semaphore. See page 104.

Mr. P. Barlow's Instrument, to correct the Local Variation of a Ship's Compass. See page 76.

Mr. C. Brandt's Spring Crutch for a Pendulum. See page 108.

Mr. E. Baker's Bullet Mould. See page 101.

Mr. J. Goodwin's Spring Cross for Horses. See page 110.

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Mr. G. Witty's Fire Escape. See page 130.

Mr. H. Earle's Bed for Patients under Surgical Treatment. See page 113.

Mr. J. Story's Portable Oven. See page 73.

Mr. J. Perkins's Instruments to ascertain the Trim of a Ship. See page 126.

Mr. Rotch's Arcograph. See page 49.

Mr. S. Lake's Double Door Hinge. See page 135.

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Digitized by Google

Digitized by Google

INDEX.

Digitized by Google

Digitized by Google

INDEX.

A.

ACORNS, the large Gold Medal to Thomas Wilkinson, Esq., for sowing 240 Bushels of, xxxvi.

——— the large Silver Medal to C. Fyshe Palmer, Esq., M.P., for sowing 216 Bushels of, xxxvi.

Advertisement, general, describing the objects of the Society:—the Meetings of the Society:—the form for proposing Members:—Ladies being eligible as Members to vote by proxy at Elections:—Members entitled to vote and assist in the business of the Society; their privilege of recommending two persons as Visitors at the Meetings of the Society, and introducing their friends to examine the various Models, &c. Members to have the use of the Society's Library:—Invitation to Members and others, to augment the Library by contributions, iii.—Form offered to persons inclined to leave money to the Society by will:—the Society not responsible for any opinion or representation of facts contained in their Volumes:—the Public guarded against impositions from persons advertising as having Patents for articles rewarded by the Society; and, also cautioned against purchasing articles sold under the pretended sanction of the Society's name:—Society's Publications:—Manner of Communicating, iv.

Agriculture, Conditions to guide Candidates in, vi. Premiums in, vi to xiii. Papers in, 1 to 42.

Allan, Mr. James, the large Silver Medal to, for his Method of dividing Circular Arcs, xl; his Communication respecting, 142.

Arcograph, the small, or Vulcan Silver Medal to B. Rotch, Esq., for an, xl.

Digitized by Google

INDEX.

B.

Baker, Mr. E., the small, or Vulcan Silver Medal to, for a Bullet Mould, xl; his Communication respecting, 101.

Barlow, Mr. P., the large Gold Medal, and a complete set of the Society's Transactions to, for his Instrument to correct the Local Variation of a Ship's Compass, xl; his Communication respecting, 76.

Barnard, Miss, the small, or Isis Silver Medal to, for an Original Painting of Flowers in Water Colours, xxxvi.

Beaumont, Miss Anne, the large Silver Medal to, for a Portrait in Oil, xxxvii.

Bed for Patients under Surgical Treatment, the large Gold Medal to H. Earle, Esq., for a, xl.

Biddulph, Miss M., the large Silver Medal to, for a Portrait in Chalk, xxxvii.

Bielefield, Mr. C. F., the small, or Isis Silver Medal to, for a Bust, xxxviii.

Biffin, Miss, the large Silver Medal to, for an Historical Miniature, xxxviii.

Bishop & Co., Mr. W., the small, or Isis Gold Medal to, for the Discovery of Mill Stone of a superior quality, in Halkin Mountain, Flintshire, xxxix; his Communication respecting, 55.

Brandt, Mr. C., the small, or Vulcan Silver Medal to, for a Spring Crutch for a Pendulum, xl; his Communication respecting, 108.

Bromley, Esq., W., the large Gold Medal to, for a finished Historical Engraving, xxxix.

Bromley, Mr. J., the large Silver Medal to, for an Etching, xxxix.

Bromley, Mr. James, the Silver Palette to, for an Etching of a Landscape, xxxix.

Bullet Mould, the small, or Vulcan Silver Medal to Mr. E. Baker, for a, xl.

C.

Cahusac, Mr. R. F., the Silver Palette to, for a Pen and Ink Drawing, xxxviii.

Digitized by Google

Carline, Mr. T., the small, or Isis Silver Medal to, for a Single Figure, xxxviii.

Catalogue of Models, Machines, &c., 185.

Chemistry, Dyeing, and Mineralogy, Premiums in, xiii to xx.

Colonies and Trade, Premiums in, xxxi to xxxiii. Papers in, 154 to 170.

Compass, the large Gold Medal to Mr. P. Barlow, for his Instrument to correct the Local Variation of a Ship's, xl.

Coppin, Miss Emily, the large Gold Medal to, for an Original Oil Painting of Fruit, xxxvi.

Cotton, Miss, the small, or Isis Silver Medal to, for an Oil Painting, xxxviii.

Crutch for a Pendulum, the small, or Vulcan Silver Medal to Mr. C. Brandt, for a Spring, xl.

Curwen, J. C. Esq., M. P., V. P., Thanks of the Society to, for a Communication on Draining, xl; his Communication respecting, 36.

D.

Davis, Miss Emma, the small, or Isis Silver Medal to, for a Portrait in Oil, xxxvi.

Davis, Mr. J. S., the Silver Palette to, for a Head in Pen and Ink, xxxviii.

Dawson, Edward, Esq., the large Gold Medal to, for Embanking Land from the Sea, xxxvi; his Communication respecting, 33.

De la Motte, Mr. W., the small, or Isis Silver Medal to, for an Etching of a Landscape, xxxix.

Dividing Circular Arcs, the large Silver Medal to Mr. James Allan, for his Method of, xl.

Door Hinge, the small, or Vulcan Silver Medal to Mr. S. Lake, for a Double, xl.

Drummond, Miss Jane, the large Silver Medal to, for a Portrait in fixed Crayons, xxxviii.

——— Miss Rose Emma, the small, or Isis Gold Medal to, for an Original Portrait in Crayons, xxxvii.

Digitized by Google

E.

Earle, H. Esq, the large Gold Medal to, for a Bed for Patients under Surgical Treatment, xl; his Communication respecting, 113.

Eggbrecht, Miss Anne, the Silver Palette to, for a Chalk Drawing from a Bust, xxxvii.

———, Mr. J. the small or Isis Silver Medal to, for a Chalk Drawing, xxxvii.

Elford, Miss Elizabeth, the Isis Silver Medal to, for a Water Colour Drawing of Flowers, xxxvi.

Embanking Land from the Sea, the large Gold Medal to Edward Dawson, Esq. for, xxxvi.

Engleheart, Mr. T. S. the Silver Palette to, for a Chalk Drawing from a Plaster cast, xxxvii.

Evatt, Miss C. H., the small, or Isis Gold Medal to, for a Copy in oil, xxxviii.

F.

Fairland, Mr. W., the smaller, or Isis Silver Medal to, for a Chalk Drawing from a Bust, xxxvii.

Fire-Escape, Ten Guineas to Mr. George Witty, for a, xl.

Firmin, Mr. A. S, the small, or Isis Silver Medal to, for a Head, xxxix.

Forest Trees, the large Gold Medal to C. Fyshe Palmer, Esq, M. P. for Planting, xxxvi.

———, the large Silver Medal to Henry Potts, Esq. for Planting, xxxvi.

G.

Goodwin, Joseph, Esq., the small or Vulcan Silver Medal to, for a Spring Cross for Horses, xl; his Communication respecting, 110.

H.

Harmer, Miss, the large Silver Medal to, for a Chalk Drawing from a Bust, xxxvi.

Digitized by Google

Hartman, Miss, the Silver Palette, for a Holy Family in Chalk, xxxvii.

Hayter, Mr. G., the large Silver Medal to, for an Etching, xxxix.

Hinge, the small, or Vulcan Silver Medal to Mr. S. Lake, for a Double Door, xl.

Huntley, Miss Georgina, the Silver Palette to, for a Group of Portraits in Water Colours, xxxvii.

Hurlstone, Mr. F. Y., the large Silver Medal to, for an Historical Painting in Oil, xxxviii.

J.

Jackson, Mr. George, the small, or Isis Silver Medal to, for an Architectural Design, xxxviii.

Jarvis, Mr. R. H., the Silver Palette to, for a Drawing in Chalk, xxxvii.

K.

Knight, Mr. Edward, the Silver Palette to, for a Landscape in Oil, xxxvii.

L.

Lake, Mr. S. the small, or Vulcan Silver Medal, for a Double Door-hinge, xl; his Communication respecting, 135.

M.

Mace, Mr. Ferderic, the large Silver Medal to, for a Bacchanalian Figure, xxxix.

Manufactures, Premiums in, xxv to xxvii; Papers in, 52 to 54.

Marbles, Resolution respecting bringing the British into general use, xxxiv.

Mechanics, Premiums in, xxvii to xxx. Papers in, 70 to 154.

Mineralogy, Papers in, 54.

Murray, Miss I., the Silver Palette to for a Head in Chalk, xxxviii.

N.

Notice to Candidates, v.

Digitized by Google

Nicolas, Mr. N. H., Lieut. R. N., the large Silver Medal to, for a Semaphore, xl; his Communication respecting, 104.

Nicholson, Mr. S., the large Silver Medal to, for a Landscape Composition in Pencil, xxxvii.

O.

Oaks for Timber, the large Gold Medal to C. Fyshe Palmer, Esq. M. P., for Planting, xxxvi.

Oaks from Acorns, the small or Ceres Gold Medal to Sir Wm. Templer Pole, Bart., for raising 896,000, xxxvi.

Oliver Mr. Robt. the small, or Isis Gold Medal to, for a Landscape in Oil, xxxvii.

Orthometer and Pleometer, the small or Vulcan Gold Medal to Mr. Jacob Perkins for his, 126.

Oven, the small or Vulcan Silver Medal to Mr. James Story, for a Portable, xl.

P.

Palmer, C. F., Esq., M. P., the large Silver Medal to, for sowing 216 Bushels of Acorns on 240 Acres, xxxvi: his Communication respecting, 30.

———, the large Gold Medal to, for planting Forest Trees, xxxvi; his Communication respecting, 6.

———, the large Gold Medal to, for planting Oaks for Timber, xxxvi; his Communication respecting, 1.

Peppercorne, Mr. J. W., the large Silver Medal to, for a Drawing in Pen and Ink, xxxvi.

Perkins, Mr. Jacob, the large Silver Medal to, for a Method of Ventilating the Holds of Ships, and Warming and Ventilating Apartments, xl; his Communication respecting, 133.

———, the small, or Vulcan Gold Medal to, for Instruments to ascertain the Trim of a Ship xl; his Communication respecting, 126.

———, The Thanks of the Society to, for his Method of Warming and Ventilating Rooms, 133.

Pole, Sir W. Templer, Bart., the small, or Ceres Gold Medal to, for raising Oaks from Acorns, xxxvi; his Communication respecting, 3.

Digitized by Google

Polite Arts, Premiums in, xx to xxiv. Papers in 43 to 51.

Potts, Henry, Esq., the large Silver Medal to, for planting Forest Trees, xxxvi; his Communciation respecting, 14.

Preece, Mr. J., the Silver Palette to, for a Copy in Plaster of the Laocoon, xxxix.

PREMIUMS offered by the Society, vi to xxxv.

I. In AGRICULTURE.

Agriculture, Conditions to guide Candidates vi. Premiums in, vi to xiii. Papers in, 1 to 42.

Ash, for having sown or set the greatest quantity of land with, vii.

Beans, for the discovery and cultivation of a species of Horse-beans or Tick-beans, ix.

Bees, for erecting an Apiary, containing the greatest number of Hives or Boxes stocked with Bees, &c., xii.

Beet-roots, for the best and cheapest method of preserving, x.

Cabbages, for the best and cheapest method of preserving Drum-headed, x.

Candidates, General Notice to, v.

Carrots, for the best and cheapest method of preserving, x.

Cattle, for the best experiments on stall-feeding, xi.

Chesnuts, for having sown or set the greatest quantity of land with Spanish, viii.

Destroying the Fly on Hops, for the discovery of an easy and efficacious method of, xi.

——— *the Grub of the Cockchafer*, for an effectual method of, xi.

——— *Worms*, for an effectual method of, xi.

Digitized by Google

Dibbling Machine, for the invention of one superior to any hitherto known, xiii.

Elm, for having planted the greatest number of English, vii.

Forest Trees, for having inclosed and planted, or set the greatest number of, vi.

Gaining Land from the Sea, for having gained the greatest quantity of, vi.

Grass Seeds, for raising the greatest quantity of, ix.

Harvesting Corn in Wet Weather, for the best and cheapest method of, xi.

Hemp, for having sown the greatest quantity of land with, x.

Improving Waste Land, for the most satisfactory account of the best method of, vi.

Irrigation of Land, for the cheapest and most effectual method of raising water for the, xii.

Larch, for having planted the greatest number of, vii.

Mangel Worzel, for the best and cheapest method of preserving, x.

Manures, for the most satisfactory set of experiments to ascertain the comparative advantages of, vi.

Norway Fir Seedlings, for having planted the greatest number of, viii.

Oaks, for the best method of raising, viii.

——, to the person who shall have raised the greatest number of, vii.

——, for having set the greatest quantity of land with Acorns, vii.

Opium, for obtaining the greatest quantity of, from the white Poppy *(papaver somniferum)*, x.

Digitized by Google

Paring Plough, for the production of one superior to any hitherto known, xii.

Parsnips, for the best and cheapest method of preserving the roots perfectly sound, x.

———, for the cultivation of the greatest quantity of land with, ix.

Plantations, for the most effectual and least expensive method of securing young, viii.

Potatoes, for the cultivation of the greatest quantity of land with, ix.

Preventing the Blight on Fruit Trees and Culinary Plants, for the most effectual method of, xi.

Securing Plantations, for the most effectual and least expensive method of, viii.

Sheep, for having protected the greatest number of, xi.

———, for the best and most effectual method of curing the foot-rot in, xii.

———, for the most effectual method of curing the rot in, xii.

———, for the most effectual method of preventing the ill-effects of flies on, xii.

Thrashing Machine, for the invention of an expeditious, effective, and moderately expensive, xiii.

Turnips, *Carrots*, *Parsnips*, *Beets*, or *Mangel Worzel*, for the best and cheapest method of preserving, x.

Walnuts, for an improved mode of propagating the superior varieties of, ix.

——— *Trees*, for having planted the greatest number of, viii.

Wheat, for the best set of experiments, to be sown broad-cast, drilled, and dibbled, ix.

II. PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH SETTLEMENTS IN THE EAST INDIES, xxxiv.

Annatto, for the importation of the greatest quantity of xxxix.

Digitized by Google

Bhaugulpore Cotton, for the importation of the greatest quantity of, xxxiv.

India Paper for Copper Plate Printing, for the best account of the process in the manufacture of, xxxiv.

True Cochineal, for the importation of the greatest quantity of, xxxiv.

III. PREMIUMS OFFERED FOR THE ADVANTAGE OF THE BRITISH COLONIES, xxxi to xxxiii.

Borer, for an effectual method of destroying the insect commonly called the, xxxii.

Cocoa Nut Oil, to the person who shall import the largest quantity of, xxxiii.

Extirpating the Stumps and Roots of Trees, for the best method of, xxxiii.

Hemp, for the cultivation of, in Lower Canada, xxxii.

——, for the cultivation of, in Nova Scotia and New Brunswick, xxxii.

——, for the cultivation of, in Upper Canada, xxxii.

——, for the discovery of a substitute for, xxxii.

——, for the importation of the greatest quantity of marketable, the produce of Canada, Nova Scotia, and New Brunswick, xxxii.

Kali for Barilla, for the cultivation of the greatest quantity of, xxxi.

Nutmegs, for the greatest quantity of merchantable, equal to those imported from the Islands of the East Indies, xxxi.

Silk, for the greatest quantity of, proper for manufactures, not less than one hundred pounds weight, produced by any person in the Isle of France, Ceylon, or Malta, &c., xxxiii.

Wool from New South Wales, for the importation of the greatest quantity of, &c., xxxiii.

——, for the production of the finest sample of, superior to the best Saxon or Spanish, xxxiii.

Digitized by Google

IV. PREMIUMS IN CHEMISTRY, DYEING, AND MINERALOGY, xiii to xx.

Acid, Sulphuric, from Sulphur, without the use of Nitric Salt, for the preparation of the largest quantity of, xiv.

Arsenic, for the discovery of a superior test for Arsenic in Solution, xiii.

Artists, for the production of a Permanent White Paint, for the use of, xix.

Brass, for a method of making, xiv.

British Indigo, for a preparation of, xviii.

Candles, for an economical mode of hardening or otherwise preparing Tallow, xiv.

Coal Gas, for the discovery of the cheapest method of purifying the inflammable Gas procured from Coal, xv.

Copper from the Ore, for a method of separating, purifying, and refining, xiv.

Cotton Cloth, for a preparation of a green colour for printing, xix.

——— for a preparation of a Red Stain for, xviii.

Crown Glass, for making Crown or Window Glass equally transparent, and as free from blue and green colour as the best German Sheet, xv.

Crucibles, for a process for manufacturing Improved Earthenware, xiv.

Dyeing Silk or Woollen, for the discovery of a superior method of, xviii.

——— *with Lac Lake*, for a process for, xviii.

——— *for Silk or Wool*, for a black dye for, xviii.

Earthenware, for Glazing without Lead or Arsenic, xv.

Flint Glass, for making, free from veins, and as dense and transparent as the best now in use, &c., xv.

Gas, for the discovery of the cheapest method of purifying Coal, xv.

Digitized by Google

Glass, for the making of Crown or Window Glass equally transparent and as free from blue and green colour as the best German Sheet, xv.

—— for the making Flint Glass free from veins, and as dense and transparent as the best now in use, &c., xv.

Green Colour for Printing Cotton Cloth, for a preparation of a, xix.

History, for the publication of the Natural, of any County in the United Kingdom, xx.

Indelible Ink, for a superior method of making, xvi.

Ink, for a superior method of making indelible, xvi.

—— for the best composition for Printing, xvi.

—— for the best composition for Copper Plate Printing, xvi.

Ireland, for the completion and publication of the most accurate Mineralogical Map of, xx.

Iron, for making the greatest quantity of Fine Bar, xiv.

—— *wrought*, for a cheap composition, superior to those in use, for the preservation of, from rust, xvi.

Lac Varnish, for the production of a colourless, xix.

Leather Water Proof, for a superior method of rendering, xvi.

Lithography, for the discovery of a Quarry of Stone within Great Britain or Ireland, fit for the purposes of, xix.

Maps, for the completion and publication of the best Mineralogical and Geological County, xx.

Mineralogical County Maps, for the completion and publication of the best, xx.

———— *Map of Ireland*, for the completion and publication of the most accurate, xx.

———— *Map of Scotland*, for the completion and publication of the most accurate, xx.

Moths, for the cheapest, most easy, and effectual method

Digitized by Google

of preventing the destructive effects occasioned by xvii.

Natural History, for the publication of, of any County in the United Kingdom, xx.

Oil for Chronometers and Watches, for the invention and discovery of the best method of distinguishing the fittest, xv.

Ores, for the most effectual method of preventing the ill-effects of smelting, xiii.

Paint, for the best substitute for the basis of White, xvii.

—— for the production of a Permanent White for the use of Artists, xix.

Pipes, for a substitute for Lead, xvii.

Preserving Seeds of Vegetables, for the best method of, xvi.

——— *Salted Provisions from becoming Rancid or Rusty*, for the discovery of a method of, xvi.

Preparation of Tan, for a preparation in the most concentrated form, &c., xviii.

Red Pigment, for a satisfactory process for preparing, xix.

—— *Stain for Cotton Cloth*, for a preparation of a, xviii.

Refining Zinc from the Ore, for the discovery of a superior process to any hitherto known of, xiv.

Salted Provisions from becoming Rancid or Rusty, for the discovery of the best, cheapest, and most efficacious method of preserving, xvi.

Scotch Fir, or Pinus Sylvestris, for the greatest quantity of Turpentine from, xvii.

Scotland, for the completion and publication of the most accurate Mineralogical Map of, xx.

Smoke, for the best and easiest means, superior to any now before the public, of preventing the emission of

Digitized by Google

dense Smoke from the Chimnies of Steam Engines, &c., xiii.

Statuary Marble, for the discovery of a Quarry of, xix.

Steam, for a method of increasing, xiii.

Stone for Lithography, for the discovery of a Quarry of Stone, within Great Britain or Ireland, fit for the purposes of Lithography, xix.

Substance for the Basis of White Paint, for the best, xvii.

Tallow Candles, for a method of hardening, or otherwise preparing, to be afforded at a less expense than those made with Spermaceti, xvi.

Tan, for a preparation of, xviii.

Tar, for the invention of a substitute for, xvii.

Timber, for the discovery of a certain method of preventing the Dry Rot in, xvii.

Turpentine from the Scotch Fir, or Pinus Sylvestris, for a preparation of the greatest quantity of, xvii.

Ultramarine, for the preparation of an Artificial, xix.

Varnish, for the production of a Colourless, xix.

Vegetables, for the best method of preserving Seeds of Plants in a state fit for vegetation, &c., xvi.

Whale or Seal Oil, for an effectual method of purifying, xv.

Wrought Iron from Rust, for a cheap composition, superior to those in use, for preserving, xvi.

V. PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE, xxx to xxxi.

Herrings, for curing the greatest quantity of white, xxx.

——— *Exporting British Cured*, premium offered for, xxxi.

Mackarel, for curing the greatest quantity of, xxxi.

Oil, for manufacturing the greatest quantity of, from Porpoises, or Sun Fish, xxx.

Digitized by Google

Porpoises, or Sun Fish, for manufacturing the greatest quantity of Oil from, xxx.

——— for taking the greatest number of, xxx.

Whales, for taking the greatest number of, with the Gun Harpoon, xxx.

VI. PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES, xxv to xxvii.

Cat-Gut, for a discovery of the best method of manufacturing, xxvi.

Chintz Patterns for Calico Printers, for the best original, xxvi.

Cloth from Hop Stalks, Nettles, &c., for the production of the greatest quantity of, xxv.

Copper Plate Patterns, for the best, xxvi.

Gloves, for making known a process equal, or superior to that of the French, for preparing, dyeing, and finishing the Skins for, xxvi.

Hose for Fire-Engines, Brewhouses, &c., for the invention of a method of making, xxvi.

Paper from Raw Vegetable Substances, for the greatest quantity of good and useful, xxv.

——— for the discovery of a method of making Transparent, xxvi.

Sheep's Wool, for the sale of the largest quantity of Merino, or such Wool as will answer the same purpose, &c., xxv.

Thread for Lace, for inventing or discovering a method of manufacturing, xxvii.

Transparent Paper, for a method of making from the pulp, xxvi.

Wicks for Candles, for the most satisfactory result of experiments to determine the best thickness of Cotton for, xxv.

——— *for Candles or Lamps,* for a method of manufac-

Digitized by Google

turing Hop Stalks, fit for the purpose of supplying the place of Cotton for, xxv.

VII. PREMIUMS IN MECHANICS, xxvii to xxx.

Carriages, for the invention and production of a method to prevent accidents from horses falling with Two-Wheeled, xxix.

Coaches, for the invention and discovery of a method of preventing accidents from Stage, xxviii.

Coals, Ore, &c. &c., for the invention of a Machine for Raising, xxvii.

Family or Portable Mill, for the invention of the best constructed, xxvii.

Fires, for the best and most effectual method of Extinguishing, xxviii.

Gunpowder Mills, for so constructing, as to prevent explosion in, xxvii.

Heating Rooms for the purpose of Manufacturers, for the invention and discovery of a superior method of, xxviii.

Improved Ventilation, for the discovery of a method, superior to any now known or used, xxviii.

Mill for Grinding Corn, for the invention of a Family or Portable, xxvii.

Needles, for the invention and production of a mode of obviating the prejudicial effects that attend the operation of pointing, xxix.

Raising the Bodies of Persons who have sunk under Water, for a cheap and portable drag for, xxix.

Roads, for the most effectual and cheapest method of improving Turnpike and other, xxix.

Rocks, for a more simple, safe, cheap, and expeditious method of boring and blasting, xxviii.

Screw, for producing an Original, xxx.

Steam Engines and other covered Boilers, for a method of preventing explosion in, xxix.

Digitized by Google

Steam Engines, &c., for the best Working Drawings in Plan, Elevation, and Section of a Condensing Steam Engine, in its most improved state, &c., xxx.

Ventilation, for the production of a mode of permanently Ventilating Apartments in Hospitals, Workhouses, &c, superior to any now known or used, xxviii.

——— *of Coal Mines*, for effectually preventing the accidents liable to arise from the accumulation of carburetted, hydrogen and other gases, xxviii.

Walking-Wheel or Crane, for the invention of an improved, xxvii.

Water, for a Machine for Raising, on a better, cheaper, and more simple construction than any hitherto known, &c., xxviii.

——— for the invention and production of a superior, cheap, and portable Drag, for raising the Bodies of Persons sunk under, xxix.

VIII. Premiums in Polite Arts, xx to xxiv.

Anatomical Models, Premiums for, xxi.

Animals, for Drawings of, and the best Original Painting of, xxii.

Architecture, for the best Drawing of, and the best Original Design in Gothic, xxii.

Artists and Others, Premiums for, xxi.

Carving in Wood, Premiums for, xxiii.

Conditions in, xxiv.

Drawings, Paintings, &c., by Artists and Others, xxi to xxiv.

——— *or Paintings, by Gentlemen or Ladies*, Honorary Premiums for, xx.

——— *or Paintings, by the Nobility*, Honorary Premiums for, xx.

Enamel Painting, Premiums for, xxiii.

Engraving of a Portrait, for the best finished, xxiii.

——— *on Steel*, for the best Specimen of, xxiii.

——— *on Wood or Metal Blocks*, for the best, xxiii.

Etching of an Historical Subject, Premium for, xxiii.

——— *of a Landscape*, Premium for, xxiii.

Digitized by Google

Flowers or Fruit, for the best Drawing, the best Original Composition in Water Colours, &c., and the best Original Composition in Oil, &c., of, xxii.

Heads or Portraits, for Drawings and Paintings of, xxi.

Historical Engravings, for the best finished, xxiii.

Honorary Premiums for Gentlemen or Ladies, xx.

Honorary Premiums for Nobility, xx.

Human Figure, for Drawings, Outlines, Copy in Oil, and Original Painting of the, xxi.

Landscape, for Drawings and Oil Paintings of, xxii.

——— *Engraving*, for the best finished, xxiii.

Lithography, for the best Specimen in the Art of, xxiv.

Medal Die Engravings, for the best, &c., xxiv.

Prevention of Forgery, for the best method of preventing the impressions of prints from being transferred from the Paper, &c., xxiii.

Perspective, for Perspective Drawings, xxiii.

Still Life, for the best Original Composition, painted in Oil or Water Colours, &c., xxii.

Presbury, Mr. G., the small, or Isis Silver Medal to, for a Chalk Drawing of the Ilissus, xxxvii.

Presents received by the Society, 177.

R.

Ranson, Mr. T. F., the small, or Isis Gold Medal to, for a finished Engraving of a Portrait, xxxix.

Reveley, George, Esq., Thanks of the Society to, for a Communication on the use of Soap instead of Oil in Setting Cutting Instruments on a Hone, xl; his Communication respecting, 137.

Rider, Mr. B., Ten Guineas to, for a Machine for Cutting Tips for Hats, xl; his Communication respecting, 71.

Rotch, Ben. Esq., the small, or Vulcan Silver Medal to, for an Arcograph, xl; his Communication respecting, 49.

S.

Salisbury, Mr. W. the small, or Ceres Silver Medal to, for Matting made of the Typha Latifolia, (or Bull-rush), xxxix; his Communication respecting, 52.

Digitized by Google

Semaphore, the large Silver Medal to Mr. N. H. Nicolas, Lieut. R. N., for a, xl.

Slous, Mr. H. C., the small, or Isis Gold Medal to, for an Oil Painting, xxxvii.

Smith, Miss Emma Maria, the Silver Palette to, for a Landscape in Pen and Ink, xxxvii.

——, Mr. C. S., the small, or Isis Gold Medal to, for a Group of Figures, xxxviii.

——, Mr. S. M., the Silver Palette to, for a Drawing in Chalk, xxxvii.

——, Mr. T., the large Silver Medal to, for a single Figure, xxxviii.

Soap, Communication by G. Reveley, Esq., on the use of Soap instead of Oil, in Setting Cutting Instruments on a Hone, 137.

Spring Cross for Horses, the small, or Vulcan Silver Medal, to Joseph Goodwin, Esq., for a, xl.

Steart, Mr. G., the small, or Isis Silver Medal to, for Improved Tablets for Drawing on, xxxix; his Communication respecting, 43.

Stephens, Miss, the Silver Palette to, for a Landscape in Oil, xxxvii.

Story, Mr. J. the small, or Vulcan Silver Medal to, for a Portable Oven, xl; his Communication respecting, 73.

Stove for Ventilation, the Thanks of the Society to Mr. Jacob Perkins, for his Method of Warming and Ventilating Rooms, 133.

Stuart, Mr. Robert, Extracts of Letters from, to Dr. Wallich, Superintendent of the Botanic Garden, Calcutta, respecting Mountain Rice, 158.

Supplement, containing a Description of Mr. Napier's Tracing Instrument, see Vol. 37, p. 63; and the rate of going of Mr. Hardy's Time-keeper, 171.

T.

Taylor, Mr. E., the large Silver Medal to, for an Architectural Design, xxxviii.

Theakston, Mr. C. D., the small, or Isis Silver Medal to, for a Copy in Plaster of the Laocoon, xxxix.

Tips for Hats, Ten Guineas to Mr. B. Rider, for his Machine for Cutting, xl.

Trim of a Ship, the small, or Vulcan Gold Medal, to Mr. Jacob Perkins, for Instruments to ascertain the, xl.

Digitized by Google

Turner, Miss, the Silver Palette to, for a Portrait in Indian Ink, xxxviii.

V.

Vendramini, Miss C., the large Silver Medal to, for a Drawing in Chalk, xxxviii.

Ventilating the Holds of Ships, and Warming and Ventilating Apartments, the large Silver Medal to Mr. Jacob Perkins, for a method of, xl.

W.

Wallich, Dr., (Superintendent of the Botanic Garden of Calcutta.) Extracts from Sundry Letters received from, on certain varieties of Rice, &c., 155.

Walter, Miss Caroline, the Silver Palette to, for a Figure in Chalk, xxxvii.

Ward, Mr. C., the Silver Medallion to, for an Architectural Design, xxxviii.

Watts, Mr. W., the large Gold Medal to, for an Historical Painting in Oil, xxxvi.

Welsh, Miss, the large Silver Medal to, for a Painting on Velvet, xxxviii.

Wilkinson, Thomas, Esq., the large Gold Medal to, for sowing Acorns, xxxvi; his Communication respecting, 26.

Williams, Mr. Penry, the large Silver Medal to, for a Chalk Drawing of the Ilissus, xxxvii.

Witty, Mr. G., Ten Guineas to, for a Fire Escape xl; his Communication respecting, 130.

Wood, Mr. J., the large Silver Medal to, for an Historical Painting in Oil, xxxvii.

Woodington, Mr. F., the Silver Palette to, for a Drawing of Figures in Indian Ink, xxxviii.

Wroughton, Miss C., the large Silver Medal to, for a Portrait in Miniature, xxxviii.

Wyon, Miss Anne, the small, or Isis Silver Medal to, for a Composition of Flowers in Wax, xxxix.

—— Mr. B., the small, or Isis Gold Medal to, for a Group of Two Figures, xxxix.

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TRANSACTIONS

OF THE

SOCIETY,

Instituted at London,

FOR THE

ENCOURAGEMENT

OF

ARTS, MANUFACTURES, AND COMMERCE;

WITH THE

PREMIUMS OFFERED IN THE YEAR 1822.

TO WHICH IS SUBJOINED

An Analytical Index

FOR

VOLUMES XXVI TO XL.

VOL. XL.

LONDON:

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ARRANGEMENT

OF THE VOLUME.

I. The PREFACE.

II. Premiums offered in 1822.
III. List of Officers.
IV. General Conditions.
V. Rewards Bestowed.

PAPERS in AGRICULTURE - - - - - - - - 1
POLITE ARTS - - - - - - - - - 41
CHEMISTRY and MINERALOGY - 45
MECHANICS - - - - - - - - - 54
MANUFACTURES- - - - - - - - 178
COLONIES and TRADE - - - - 230

APPENDIX - - - - - - - - - - - - - - 241
PRESENTS received - - - - - - - - - - 261
MODELS and MACHINES of the present Year - 269

LIST of MEMBERS.
INDEX.
ANALYTICAL INDEX for Volumes XXVI to XL.

Digitized by Google

LIST OF PLATES IN VOL. XL.

1. Messrs. Cowley and Staines' instruments employed in the culture of the White Poppy, and the extraction of Opium.
   Mr. Marshall's Blocks for Calico-printers.
2. Mr. Pering's Iron Gun-carriage.
   Mr. Biddle's Hay-borer.
3. ...Mr. Richards's Draw-boy.
4. 5. 6. 7. Mr. Thompson's Ribbon-loom.
8. ...Mr. Reveley's Tuscan Millstones.
9. Mr. Holditch's Life Beacon.
   Mr. Goodwin's Bridle-bit.
   Mr. Millikin's Bistoury.
10. Lieut. Littlewort's Compass.
    Captain Gordon's Life Boat.
11. Mr. Watson's system of Musical Notation for the use of the Blind.
12. 13. 14. Mr. Thom's Self-acting Hydraulic Apparatus for regulating the supply of Water to Mills, &c.
15. ...Mr. Busby's Hydraulic Orrery.
16. ...Mr. Wynn's Hammer for a Turret Clock.
17. Mr. Bowler's Rat Trap.
    Mr. Baker's Gun-lock.
18. ...Mr. Hookey's Coffer for repairing Ships Afloat.
19. ...Mr. Hall's Steam-engine-Boiler.
20. Mr. Wigzell's Sliding-rule for marking a Ship's place on a Chart.
21. Mr. Bailey's method of Opening and Shutting Church Windows, &c.
22. ...Mr. Savage's Watch Escapement.
23. Mr. Abraham's Magnetic Guard for Persons employed in Dry-grinding.
24. Mr. Ainger's Hydrometer.
    Diagram explaining Mr. Rotch's Arcograph.
    Method of Forming and Knitting Leghorn-plat.

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PREFACE.

THE Committee of Correspondence and Papers to whom the Publication of the Society's Transactions is entrusted, submit to the Society, and to the public at large, a general Summary of the contents of the present Volume.

The class of Agriculture and Rural Economy contains four Communications; one of which, by Messrs. Cowley and Staines, has obtained the Large Gold Medal, being the Premium offered for the ascertainment of certain important points of practice in Turnip Husbandry. These Gentlemen have drawn a crop of full-grown Turnips sufficiently early in the Winter to admit of the Land being prepared for a crop of Wheat; which Turnips being stacked, were preserved in a sound state fit for feeding cattle to the end of April in the following Spring. Two circumstances appear to have contributed to the successful preservation of the Turnips, namely, the state of dryness in which they were kept, but principally the great care that was taken to wound the roots as little as possible, and especially, in topping

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the Turnips, to avoid any injury to the buds of the crown.

An interesting Communication from the same Gentlemen contains the particulars of their cultivation of the White Poppy, and of their obtaining therefrom, 60*lbs*. of excellent Opium.

J. Peart, esq. has gained a Gold Medal, for reclaiming Waste Moor Land, by converting it to permanent Pasture: the process, though expensive, has upon the whole succeeded, and is applicable to many thousand acres of rough mountainous land similarly situated.

Mr. Biddle's description of a cheap, simple, and effectual instrument for boring haystacks, in order to ventilate them when in danger of firing, or for the purpose of drawing a sample, in order to ascertain the quality of the Hay, will no doubt be duly appreciated, both by the growers and purchasers of this important article.

The class of Polite Arts contains a communication from Mr. Lupton, on the application of the art of Mezzotinto Engraving to plates of soft steel, instead of copper as heretofore practised. The capricious uncertainty in the number of copies which a copper mezzotinto plate will furnish, has always prevented the extension of

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this branch of Art, notwithstanding its many advantages in point of expedition, economy, and picturesque effect. This objection is completely avoided by working on steel, and the additional labour is far more than compensated by the increased number of copies which such a plate will afford, when compared with even the most successfully executed copper one.

The class of Chemistry and Mineralogy includes two Communications. One of these by Mr. H. W. Reveley, on the Mill-Stones at present made use of in Tuscany, is interesting on two accounts; first, the superior method of dressing the Stones which it points out, which is applicable to Mill-Stones of all kinds; and secondly, as making known two materials employed in that country in preparing the finest Wheat Flour, which materials, although abundant in this Island, have hitherto served no useful purpose whatever, except as materials for roads.

The second Communication is from J. Meigh, esq., on the discovery of a cheap and effectual glaze for the common coarse red Earthenware, by which not only the solidity of the ware is greatly increased, but the hitherto presumed necessity of employing vitrified lead, as the material of the glaze is wholly avoided. The direful effects of the poison of lead manifested by severe

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cholics, by paralysis of the limbs, and by untimely death, as manifested in the workmen employed in common house-painting, and in manufactories of White Lead are but too well known to medical men, and to all persons of general observation. It is not however sufficiently adverted to, that the same dangerous mineral constitutes the glaze of the common red Earthenware, in which the food of the lower classes is mostly prepared; in this state it is slightly soluble in animal oil, and more copiously in the acids of our common fruits, especially when their action is assisted by the heat necessary for cooking these articles. Many of the obscure visceral diseases of the poorer classes are greatly to be attributed to this little-suspected source, and the temporary removal of the pain occasioned by them, is one of the many motives which lead to the habitual use of distilled spirits. A knowledge of these circumstances induced the Society to offer their largest honorary premium for the discovery of a glaze composed of materials not prejudicial to health, and which, from its cheapness and fusibility at the comparatively low temperature at which the red Earthenware is baked, may supersede the use of glaze of lead. This important problem has been successfully resolved by Mr. Meigh, and the Committee feel assured, that in communicating to the public the process employed by that manufacturer, they

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are putting it in the power of all others engaged in the same branch of business, at the same time to improve the quality of their ware, and to remove a source of much mischief to the health of those who are compelled by pecuniary considerations to make use of it.

In the class of Mechanics, Mr. Thom's Hydraulic Apparatus for regulating the supply of Water to Mills, and Mr. Hall's method of supplying water to the Boilers of Steam Engines will be found to contain several useful hints and points of practice to the Civil Engineer.

Mr. Pering's Wrought-Iron Carriage for Ship Guns, and Mr. Hookey's Coffer for repairing Ships afloat, especially for stopping up shot-holes, and removing defective sheets of copper within a few feet of the surface of the water, will be found useful, both in Ships of War and in the larger class of Merchant Vessels; while Lieut. Littlewort's Ship's Compass, and Mr. Wignell's instrument for marking a Ship's place on a Chart, are calculated to increase the resources of the Navigator, and to enable the Masters of Merchantmen to attend more than in general they have hitherto done to the higher and more scientific parts of their profession.

The rewards granted to Mr. Holditch for his

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Life Beacon, and to Capt. Gordon for his Life Boat, evince the continued attention of the Society, to whatever can diminish the perils of Navigation; while similar motives have determined the bestowal of the Gold Medal to Mr. Abraham, for his disinterested and active humanity, and his zealous personal exertions in inventing and urging the adoption of apparatus for the purpose of obviating the injurious effects of Dry-Grinding, as usually practised.

Mr. Ainger's General Correctional Scale for Temperature as applied to Hydrometers, will be found very useful, both in analytical and practical investigations, as combining great accuracy with expedition and facility of manipulation. Mr. Savage's Detached Escapement, Mr. Wynn's Hammer for Turret Clocks, Mr. Watson's System of Musical Notation for the use of the Blind, Mr. Baker's Improved Main Spring for Fire Arms, Mr. Bailey's Apparatus for conveniently Opening or Shutting the Windows of Churches, and other Public Buildings, Mr. Bowler's Trap, and Mr. Millikin's Bistoury, are sufficiently denoted by their titles, and require no particular remark.

Mr. Busby's Hydraulic Orrery is an ingenious idea, which has been partly carried into execution, of producing circular motions representing those

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of the primary and secondary planets, by the mere impulse of lateral jets from syphons communicated to a system of floats revolving in one common circular bason.

The class of Manufactures contains seven Articles, one of which, is an improvement by Mr. S. Marshall, in the Wooden Blocks employed by Calico Printers; the object of which is, at the same time to increase the expedition and the precision of the work performed.

Two Articles relate to sundry Improvements introduced into the Draw-Boys attached to the Looms for Weaving Figured Silks, by two ingenious mechanics of Spitalfields, Mr. Hughes and Mr. Richards; and a third, to a much more important and elaborate Improvement added to the Ribbon Weavers' Loom, by Mr. Thompson, of Coventry.

By this latter Instrument, the manufacturer is enabled to produce articles which may successfully vie with the before unrivalled workmanship of the French and Italian artists; and the result cannot fail to be a still farther increase of activity in a branch of British industry, which has already received an increase of nearly one third since the termination of the Continental war.

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Another, and by no means unimportant Manufacture, has received the notice of the Society. During the war from which we have not long emerged, the use of hats and bonnets of split wheaten straw was general among the females of every rank, the relative fineness of the platting, and delicacy of colour, forming the chief distinction between the high and the low-priced ones. The platting, which was wholly done by hand, formed a healthful and profitable employment for the wives and daughters of the labouring class, in the counties of Hertford, Bedford, Buckingham, and other parts adjoining. On the return, however, of commerce to its usual channels, hats of Leghorn plat found an easy entrance into the country, and met with a rapid sale, partly perhaps from the caprice of fashion, but also, from their real and incontestable superiority, both in beauty of material, in fineness of workmanship and durability, over the straw hats of native make. The consequence, however, of this diminished demand for our domestic manufacture, was the throwing out of employ many persons who had been accustomed to live reputably and in comfort on the produce of their industry, and much suffering was, in consequence, undergone by a very deserving part of the community. In the last Session a bonnet was laid before the Society, manufactured by the daughter of a farmer of

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Connecticut, in the United States, which in colour and fineness of material, considerably exceeded the best specimens of Leghorn plat. On inquiry, it was found that this material is one of the most common indigenous grasses in that part of North America; and the idea immediately suggested itself to the Society, of reviving our own manufacture of fine plat, either by encouraging the importation of the raw material, or by procuring a quantity of the seed and raising the grass at home, in case our climate should be found not adverse to the project. A reward both honorary and pecuniary, was accordingly voted to Mrs. Wells, the inventress, on condition of the particulars of the manufacture being communicated to the Society, together with a certain quantity of the seed. These stipulations were complied with, the greater part of the seed has been distributed in England and in Ireland, has germinated, and the plants are now in a flourishing state. As a collateral aid in the object the Society had in view, they gladly bestowed their Silver Medal on Mr. Parry, for his successful ingenuity in first himself acquiring, and then teaching to others, the method of platting according to the Italian pattern.

The four rewards in the class of Colonies and Trade, and one in that of Manufactures have been bestowed with the intention of benefitting the

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Colony of New South Wales. This settlement, the only European establishment on an island, the superficial extent of which is not much inferior to that of the Continent of Europe, is even now an object of great and yearly increasing interest. Its climate healthful, and similar in temperature to that of Madeira, holds an intermediate position between that of the mother country and of our intertropical possessions, precluding it from commercial competition with either, and at the same time assuring to it the speedy acquisition of those rich productions which characterize the southern and middle countries of Europe. Its population, British, or of British origin, amounts at present to about 40,000, well-disposed to exchange the new products of their laborious activity for the comforts, the conveniencies, and even the elegancies and luxuries of civilized life. Nothing, therefore, is wanting to put this Colony in the way of becoming, perhaps, the most valuable dependency of the Empire, than to encourage the raising and importing of those products which at the same time that they afford the settlers convenient articles of remittance may furnish the staple and raw material to some of our principal manufactures. With this view, the Society in the Session before last offered two Gold Medals, one for the importation of the largest quantity of fine wool, the growth of New South Wales, and a second for the importation of wool from the

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same country of such a degree of fineness as shall render it applicable to the same uses as the best wools of Spain and Saxony, which are imported into this country to the average annual amount of 16,000,000 *lbs.* Both these medals were claimed by, and have been awarded to J. Macarthur, esq., the former for having sent to the London market, above 15,000 *lbs.* of fine wool, the produce of his Merino flocks in New South Wales; the other for wool from some of his select fleeces, which after having been sorted by one of the partners in a Mercantile house through whose hands most of the finest qualities of Saxon Wool are transmitted, was declared by the principal Wool Brokers of the metropolis to be equal to the best, or Electoral, Saxon Wool. In confirmation of the correctness of the judgment thus pronounced, a specimen of broad cloth made by Messrs. Starkey and Co. of Huddersfield, entirely of New South Wales Wool, purchased out of the last year's importation, was laid before the Society, for which the lesser Gold Medal has been awarded to the Manufacturer.

Medals have also been given to Mr. J. Raine, for his exertions in creating a Commercial demand for the Wool grown in Van Diemen's Land, and for the successful capture of Sea Elephants (a large species of Seal abounding in oil) at Mac-

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quarrie's Islands situated to the South of the last-mentioned Settlement.

Here the Committee would willingly conclude, but a sense of justice, as well as obedience to the directions of the Society, compel them to make the following statement:

On referring to the 39th Volume, it will be found that the Silver Vulcan Medal was bestowed on Mr. Samuel Lake, a member of the Society, for a Double Door Hinge. It has been since proved, in consequence of a special investigation into the subject, that this Hinge, with the exception of a very trifling alteration, not for the better, was copied by Mr. Lake from one put up by Mr. J. Cooper, of Northumberland-street, New Road, in the house of Mrs. Ross, of Baker-street, in the year 1818. In consequence of the above investigation, the Society have come to the following resolution, "That Mr. Lake having been "detected in imposing on the Society, he be re-"quired to return the Medal so obtained, and be "expelled the Society."

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SOCIETY

FOR THE

ENCOURAGEMENT

OF

ARTS,

MANUFACTURES,

AND

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IN THE SESSION 1822—1823.

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ADVERTISEMENT TO THE PUBLIC.

THE chief object of the SOCIETY is, to promote the Arts, Manufactures, and Commerce of this Kingdom, by giving honorary or pecuniary Rewards, as may be best adapted to the case, for the communication to the SOCIETY, and through the SOCIETY to the Public, of all such useful Inventions, Discoveries, and Improvements (whether specified in these Premiums or not) as tend to that purpose; in pursuance of this plan, the SOCIETY have already expended upwards of a HUNDRED THOUSAND POUNDS, derived from voluntary subscriptions and legacies.

The meetings of the SOCIETY are held every Wednesday, at seven o'clock in the evening, from the first Wednesday in November to the second Wednesday in June. The Committees meet on other evenings in the week during the session, for the purpose of taking into consideration the subjects referred to them by the SOCIETY. A person desirous of becoming a Member of the SOCIETY, may be proposed according to the following form, which must be signed by three Members of the SOCIETY, and delivered in to the Secretary:

A. B. [*Trade, Profession or Designation of the Candidate*] proposed as a Member of the Society for the Encouragement of Arts, Manufactures, and Commerce by

C. D.
[*Date*] E. F.
G. H.

Peers of the Realm, or Lords of Parliament are, on their being proposed, immediately balloted for: the names of other persons proposed to become Members are read by the Secretary to the SOCIETY, and are then inserted in lists which are hung up in the SOCIETY's room; they are balloted for at the second following ordinary meeting. In both cases, if two-thirds of the Members then voting ballot in their favour, they are deemed Perpetual Members upon payment of not less than Twenty Guineas in one sum, or Subscribing Members upon payment of any sum not less than Two Guineas annually.

Ladies are eligible as Members of the SOCIETY, and alone are entitled to vote by proxy at elections, through the medium of any gentleman who is a Member, on his producing a written authority for the same.

Members are entitled to vote and assist in all the business of the SOCIETY and of the several Committees. They have also the privilege of recommending two persons as visitors at the meetings of the SOCIETY; and, by addressing a note to the housekeeper, of introducing their friends on any week day, except Wednesday, between the hours of ten and two, to examine the various Models, Machines, and Productions, in different branches of Arts, Manufactures, and Commerce, for

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which rewards have been bestowed; also to inspect the magnificent series of Mo and Historical Paintings, executed by the late J. BARRY, Esq. which, with so valuable Busts, Statues, Portraits, &c. decorate the public rooms of the SOCIETY

Members have the use of the SOCIETY's Library, which is valuable, and annu increasing by the purchase and donation of scientific and useful books, and of gravings. Contributions from Members and others, in augmentation of Library, and of the collection of Maps and Prints, will be thankfully received, duly acknowledged in the annual volume of the Society's Transactions, to a co of which every Member is entitled.

*** To persons inclined to leave a sum of money to this SOCIETY by Will, following form is offered for that purpose:

ITEM.—*I give and bequeath to A. B. and C. D. the sum of u condition, and to the intent that they, or one of them, do pay the same to Collector for the time being, of a Society in London, who now call themse the Society for the Encouragement of Arts, Manufactures, and Commer which said sum of I will and desire may be paid out of personal estate, and applied towards carrying on the laudable designs of Society.*

The SOCIETY desire it to be clearly understood, that as a Body they are not sponsible for any opinion or representation of facts contained in their Volumes. A the Public are requested to guard against impositions, from persons advertising having Patents for Articles rewarded by the SOCIETY; they are also cautio against purchasing articles sold under the pretended sanction of the SOCIET name.

The SOCIETY have lately published the 39th *Volume* of their Transactions, wh may be had by Members on application to the Housekeeper. Complete SETS their TRANSACTIONS, or any single Volume, may be purchased at the SOCIET house: where may be had also,

An *Analytical Index of the first Twenty-five Volumes* of the Transactions to Termination of the Session, June, 1807, price 2*s.* 6*d.*

A List of the Machines and Models in the SOCIETY's Repository, to the year 18 inclusive, *gratis.*

A Catalogue of Books in the SOCIETY's Library, 1*s.*

A Description of Mr. Barry's Paintings in the Great Room of the SOCIETY, *gra*

All communications are to be made by letter, addressed to ARTHUR AIKIN, E the Secretary, at the SOCIETY OF ARTS, &c. Adelphi, London.

And where articles are sent by Sea for the SOCIETY, the Bills of Lading are to addressed to the care of WILLIAM VAUGHAN, Esq., 70, Fenchurch-street, Lond who has undertaken to receive them for the SOCIETY.

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GENERAL NOTICE TO CANDIDATES.

THE great object of the SOCIETY in rewarding individuals is, to draw forth and give currency to those inventions and improvements which are likely to benefit the public at large. Candidates are therefore requested to observe, that if the means by which the respective objects are effected, require an expense or trouble too great for general purposes, the SOCIETY will not consider themselves bound to give the offered reward; but, though they expressly reserve the power, in all cases, of giving such part only of any premium as the performance shall be adjudged to deserve, or of withholding the whole if there be no merit, yet the Candidates may be assured the SOCIETY will always judge liberally of their several claims.

The SOCIETY by no means restrict their liberality to the subjects for which premiums are specially offered, but will take into consideration, and will reward, by a bounty proportioned to its merit, any communication, the subject of which is of a practical nature, and calculated to promote the public good.

All communications are to be made by letter addressed to the Secretary, and are to contain full and particular details, according to the nature of the Subject, as well as accurate descriptions of such drawings and Models as form part of the communication: the Models to be sent CARRIAGE PAID.

In those cases in which certificates are required to be produced in claim of premiums, they should be expressed, as nearly as possible, in the words of the conditions attached to the respective premiums, and be signed by disinterested persons, who have a positive knowledge of the facts stated.

The premiums are designed for the United Kingdom, unless expressly mentioned to the contrary; but no claim will be attended to, unless the previous conditions have been fully complied with.

No person shall receive any premium, bounty, or encouragement, from the SOCIETY, for any matter for which he has obtained any premium or reward from any other SOCIETY, or for which he has obtained, or purposes to obtain a patent; it being a condition stipulated with every candidate, that all articles rewarded by the SOCIETY, shall be freely given up to the public, to be made or manufactured by any person whatever.

All Models, the production of which is attached as a condition to any premium, shall, upon the delivery of such premium, remain the property of the SOCIETY.

Where premiums or bounties are obtained in consequence of specimens produced, the SOCIETY will retain such part of those specimens as they may judge necessary, making a reasonable allowance for the same.

No member of this SOCIETY shall be a Candidate for, or entitled to receive, any premium, bounty, or reward whatsoever, except the honorary medal of the SOCIETY.

No Candidate, not a member, shall be present at any meeting of the SOCIETY or Committees, or admitted at the SOCIETY's rooms, after they have delivered in their claims, until such claims are adjudged, unless summoned by the Committee.

A Candidate for a premium, or a person applying for a bounty, being detected in any attempt to impose on the SOCIETY, shall forfeit such premium or bounty, and be deemed incapable of obtaining any for the future.

The consideration of the Claims for the premiums offered in the present List, will take place during the Session of the SOCIETY commencing on Wednesday, the 6th of November, 1822. The several Candidates and Claimants, to whom the SOCIETY shall adjudge Premiums or Bounties, are to attend on the last Wednesday in May, at eleven o'clock in the forenoon precisely, to receive the same, that day being appointed by the SOCIETY for the Distribution of their Rewards; and before that time no Premium or Bounty will be delivered, except to those who are about to leave the Kingdom.

In cases where the SOCIETY may think fit to admit excuses for not attending in person, Deputies may be substituted to receive the rewards, provided such Deputies are either Members of the SOCIETY, or superior Officers thereof.

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PREMIUMS IN AGRICULTURE.

N. B.—The Winchester bushel is the measure referred to for grain; and, as the Acres of different districts vary in extent, it is necessary to observe, that the Society mean Statute acres of five and a half yards to the rod or pole, and they request that all communications to them may be made agreeably thereto.

1. Improvement of Land.

Gaining Land from the Sea.

1. TO the person who shall have gained the greatest quantity of Land from the Sea, not less than fifty acres, on the coast of Great Britain or Ireland; —*the Gold Medal.*

Certificates of the quantity of Land, and that the experiments were begun after the first of January, 1817, to be produced to the Society on or before the first Tuesday in February, 1823.

2. The same premium is extended one year farther, on the same conditions.

Improving Waste Land.

3. For the most satisfactory account of a method, superior to any hitherto practised, of improving Land lying Waste and uncultivated, in which either of the following soils predominate, viz. clay, gravel, sand, chalk, peat, or bog, verified by experiments on not less than fifty acres of land;—*the Gold Medal.*

4. For the next greatest quantity, not less than thirty acres;—*the Silver Medal.*

It is required, that the Land, before such improvement, be absolutely uncultivated, and in a great measure useless, and that in its improved state, it be inclosed and cultivated.

Certificates of the number of acres, of the quality of the Land so improved, with a full account of every operation and expense attending such improvement, the state it is in as to the proportion of grass to arable, and the average value thereof, to be produced to the Society on or before the first Tuesday in February, 1823.

Laying down Light Land to Permanent Grass.

5. To the person who shall ascertain, by actual experiment, the comparative merit of the following modes of laying down Light Soils to Permanent Grass, with a view to obtain a good sward in the shortest time, viz. by inoculating or transplanting, as recently practised in the county of Norfolk, either with or without corn, by sowing grass seeds in the Spring, in the common way, with corn, buck-wheat, &c. or by sowing grass-seeds alone in the Autumn;—*the Gold Ceres Medal.*

It is required that every operation, and the expense of each mode, be fully described, with proper certificates of the soil and subsoil in each experiment being respectively of similar qualities, and of their having previously been similarly treated as to cultivation and manure, and of at least one acre having been tried under each system, to be produced to the Society on or before the last Tuesday in February, 1823.

Manures.

6. For the most satisfactory set of experiments, to ascertain the comparative advantages of the following Manures, used as top-dressings on grass and corn land, viz. soot, coal-ashes, wood-ashes, lime, gypsum, bones, night-soil, or any other fit article;—*the Gold Medal.*

It is required that the above experiments be made between four of the above-mentioned Manures, and that not less than two acres of land be dressed with each Manure.

7. For similar comparative experiments on two or more kinds of Manure; —*the Silver Medal.*

An account of the nature of the soil, quantity, and expense of the manure and crops, with certificates, to be produced on or before the last Tuesday in February, 1823.

2. Plantations.

Forest Trees.

8. To the person who shall have inclosed and planted, or set, the greatest number of acres (not less than fifty) of land that is incapable of being ploughed,

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or otherwise unfit for tillage, with the best sorts of Forest Trees, namely, oak, Spanish chesnut, ash, elm, beech, alder, willow, larch, spruce, or silver fir (with or without screens of Scotch fir) adapted to the soil, and intended for timber trees, between the first of Oct. 1818, and the first of April 1819;—*the Gold Medal.*

9. For the second greatest quantity of land, not less than thirty acres;—*the Silver Medal.*

A particular account of the methods used in making and managing the plantations, the nature of the soil, the probable number of each sort of plants, together with proper certificates that they were in a healthy and thriving state two years at least after making the plantations, to be delivered to the Society on or before the second Tuesday in February, 1823.

N. B. With the above Forest Trees, the seeds, cuttings, or plants, of such other trees as are adapted to the soil, and proper for underwood, may or may not be intermixed.

Oaks, not transplanted.

10. For having set, in the season 1816-17, the greatest quantity of land, not less than fifteen acres, with Acorns, with or without seeds, cuttings, or plants of other trees, at the option of the candidate; and for effectually fencing and preserving the same, in order to raise timber;—*the Gold Medal.*

11. For the second greatest quantity of land, not less than ten acres, set agreeably to the above conditions;—*the Silver Medal.*

Certificates of setting agreeably to the above conditions, and that there are not fewer than three hundred young Oaks, in good condition, on each acre, to be delivered to the Society on or before the first Tuesday in February, 1823.

Larch.

12. For having planted out, between June, 1819, and June, 1820, the greatest number of Larch Trees, not fewer than fifty thousand, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

13. For the next greatest number, not fewer than thirty thousand;—*the Silver Medal.*

Certificates of the number of plants, that they were in a healthy and thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the last Tuesday in February, 1823.

N. B. The Larch Trees may be planted either mixed with other trees, or by themselves, as may best suit the convenience of the planter.

Norway Fir.

14. To the person who shall have imported from Norway the greatest number, not less than two thousand, of Norway Fir Seedlings, and shall have planted the same during the year 1820, placing them at sufficient distances from each other to stand for timber trees;—*the Gold Medal.*

Certificates of the number of plants, that they were in a thriving state two years at least after they were planted out, with a general account of the methods used in making the plantation, to be delivered to the Society on or before the first Tuesday in February, 1823.

N. B. It is recommended to plant seedlings of about three or four years growth, and in a moderately good soil, somewhat sheltered; the wood from the district of Christiana is esteemed the best for carpenters' and joiners' use; and for spars and ufers the trees near to Long Sound are most valued.

Walnut Trees.

15. For having planted the greatest number of Walnut Trees, not less than two hundred, since June, 1820, and for having effectually fenced and preserved the same, in order to raise timber;—*the Gold Medal.*

16. For the next greatest number, not fewer than one hundred;—*the Silver Medal.*

Certificates of having planted agreeably to the above conditions, and that the plants were in a healthy and thriving state two years at least after making the plantation, and specifying the distance of the plants from each other, to be delivered to the Society on or before the first Tuesday in April, 1823.

Securing Plantations.

17. To the person who shall give to the Society the most satisfactory account, founded on experience, of the most effectual and least expensive me-

thod of securing young plantations of timber trees and hedge rows, from hares and rabbits, as well as from sheep and cattle, which at the same time shall be least subject to the depredations of wood-stealers;—*the Gold Ceres Medal*, or *Thirty Guineas.*

The accounts, and certificates of the efficacy of the method, to be produced to the Society on or before the last Tuesday in March, 1823.

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3. Comparative Experiments on raising Trees.

Oaks.

18. To the person who shall have ascertained in the best manner, by actual experiment, continued for five years at least, the comparative merits of the different modes of raising Oaks for timber, from acorns set on land properly dug or tilled, from acorns set by the spade or dibble, without digging or tillage, either on a smooth surface, or among bushes, fern, or other cover; and from young plants previously raised in nurseries, and transplanted: regard being had to the expense, growth, and other respective advantages of the several methods;—*the Gold Medal.*

The accounts and proper certificates that not less than one acre has been cultivated in each mode, to be produced to the Society on or before the first Tuesday in February, 1823.

Walnuts.

19. To the person who shall communicate to the Society an improved mode of propagating the superior varieties of Walnuts, either by budding, grafting, or any other mode, except sowing;—*the Gold Medal.*

Certificates that not fewer than fifty trees have been so raised; with a full account of the method practised, to be produced to the Society on or before the first Tuesday in April, 1823.

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4. Cultivation of Corn and other Plants.

Wheat.

20. For the best set of experiments made on not less than twelve acres, four acres being sown broad-cast, four drilled, and four dibbled, in order fully to ascertain which is the most advantageous mode of cultivating wheat;—*the Gold Medal.*

It is required that every operation, and the expense of each mode of culture, be fully described; and that proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce of the corn, the weight per bushel, and also of the straw, be produced to the Society on or before the last Tuesday in February, 1823.

Grass Seeds.

21. To the person who shall raise the greatest quantity of each or any of the following named grass seeds, viz.—Meadow Fox-tail (alopecurus pratensis), Sweet-scented Vernal-grass (anthoxanthum odoratum), Timothy-grass (phleum pratense), meadow Fescue-grass (festuca pratensis), smooth-stalked Meadow-grass (poa pratensis), rough-stalked Meadow-grass (poa trivialis), rough Cock's-foot (dactylis glomerata), perennial Ray-grass (lollium perenne);—*the Silver Medal.*

It is required that certificates from persons who have viewed them in a proper state to identify that they are one or other of the seeds above-mentioned, indicating clearly the particular species, and noticing the quantity produced of such seeds, free from weeds or mixture of other grasses, together with proper samples of the seeds, be produced to the Society on or before the first day of March, 1823.

Beans.

22. To the person who shall discover and cultivate, on not less than five acres, a species of Horse-beans or Tick-beans that will ripen their seeds before the 21st of August;—*the Silver Medal.*

It is required that a particular account of the bean, the cultivation, and the expense attending it, with proper certificates of the nature and condition of the land on which the experiments were made, together with an account of the produce, the weight per Winchester bushel, and a sample of not less than a peck, be produced to the Society on or before the last Tuesday in February, 1823. It is apprehended that if a Bean should be brought into cultivation with the habits of hotspur or other early peas, it would in a great measure escape the danger arising from the collier insect, or other insects, and allow more time for the farmers to till the land for the subsequent crop of wheat.

Parsnips.

23. To the person who shall cultivate the greatest quantity of land, not less than five acres, with Parsnips, for the particular purpose of feeding cattle or sheep;—*the Gold Medal.*

Certificates of the quantity of land so cultivated, with a particular account of the nature of the soil and weight of the produce on sixteen perches, and also of the condition of the cattle or sheep fed with the Parsnips, and the advantages resulting from the practice, to be produced to the Society on or before the last Tuesday in February, 1823.

Potatoes.

24. To the person who shall, in the year 1823, cultivate the greatest quantity of land, not less than fifty acres, with Potatoes of such qualities as shall be fit for the use of the table in the months of April, May, and June, 1824;—*the Gold Medal,* or *Thirty Guineas.*

Proper certificates, along with other necessary particulars, to be delivered in to the Society on or before the first Tuesday in Nov. 1824.

Preventing the rotting of Clover Plants.

25. To the person who shall communicate to the Society, a satisfactory account of some method or methods successfully employed in preventing the failure of Clover Crops, in consequence of the Plants rotting on the ground in the Winter and Spring; which they commonly do in patches, appearing to extend from a center;—*the Gold Ceres Medal.*

Full particulars and satisfactory certificates to be produced to the Society on or before the second Tuesday in March, 1823.

Hemp.

26. The Society, wishing to encourage the growth of Hemp, in every part of the united empire, for the use of the navy, offer to the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the greatest quantity of land in any part of the united empire, not less than fifty acres statute measure in the year 1822, and at the proper season shall have caused to be plucked the summer Hemp (or male Hemp bearing no seed), and continue the winter Hemp (or female Hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal.*

27. To the person who shall have sown with Hemp, in drills at least eighteen inches asunder, the next greatest quantity of land in any part of the united empire, not less than twenty-five acres, statute measure, in the year 1822, and shall at the proper season cause the same to be plucked as above-mentioned;—*the Silver Medal.*

Certificates of the number of acres, of the distance of the drills, of the plucking of the Hemp, with a general account of the soil, cultivation, and produce, to be delivered to the Society along with fourteen pounds of the Hemp and two quarts of the seed, on or before the last Tuesday in February, 1823.

Cultivation of the white Poppy (Papaver somniferum) and Extraction of the Opium.

28. To the person who shall obtain the greatest quantity of Opium, not less than 20 lbs. from the white Poppy (Papaver somniferum), raised by the claimant, in Great Britain or Ireland, in the year 1822;—*the Gold Ceres Medal,* or *Thirty Guineas.*

Certificates of the quantity and quality of the produce, with specimens, and a full description of the mode of culture, and of the extraction and preparation of the Opium, to be sent to the Society on or before the first Tuesday in February, 1823.

29. The above premium is extended to the succeeding year on similar conditions.

Persons proposing to claim the above premium are referred to Mr. Young's communications on the subject, published in the 37th and 38th Vols. of the Society's Transactions.

A valuable communication on the same subject will be inserted in the 40th Volume.

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5. Preservation of Vegetable Produce.

Preserving Turnips, Carrots, Parsnips, Beets, or Mangel Wurzel.

30. To the person who shall discover to the Society the best and cheapest

method of preserving these roots perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal.*

It is required that a full and accurate account of the method employed, and the expense attending the process, together with certificates that the produce of four acres, at the least, has been preserved according to the method described, and applied to the feeding of sheep and neat cattle; that the whole were drawn out of the ground before the first day of January, in order to clear the greater part of it previous to its being prepared for corn, and to save the soil from being exhausted by the turnips or other roots, and also of the weight of an average sixteen perches of the crop; be produced to the Society on or before the last Tuesday in April, 1823.

31. For the next in quantity and merit, on not less than two acres;—*the Silver Medal.*

Preserving Cabbages.

32. To the person who shall discover to the Society the best and cheapest method of preserving drum-headed Cabbages perfectly sound, and in every respect fit for supporting and fattening sheep and neat cattle during the months of February, March, and April;—*the Gold Medal.*

33. For the next in quantity and merit, on not less than two acres;—*the Silver Medal.*

Conditions the same as for preserving turnips, Art. 30.—And the accounts to be produced on or before the last Tuesday in April, 1823.

Harvesting Corn in Wet Weather.

34. To the person who shall discover to the Society the best and cheapest method, superior to any hitherto practised, of Harvesting Corn in Wet Weather;—*the Gold Medal.*

A full account of the method employed, and of the expense attending the process, with not less than two sheaves of the corn, and certificates that at the least the produce of ten acres has been harvested according to the method described, and that the whole is of equal quality with the samples; to be produced to the Society on or before the first Tuesday in February, 1823.

6. Destroying Insects an other Vermin.

Destroying the Grub of the Coc chafer.

35. To the person who shall discov to the Society, an effectual method, ve fied by repeated and satisfactory trial of destroying the Grub of the Cockchafe the Wire-worm, or the Slug, or of pr venting or checking their destructiv ravages on corn, peas, beans, and tu nips;—*the Gold Medal.*

The accounts, with proper certificates, be produced on or before the first Tuesda in February, 1823.

Destroying the Fly on Hops.

36. To the person who shall discove to the Society an easy and efficaciou method of destroying the Fly on Hop superior to any hitherto known;—*th Gold Medal.*

Accounts and certificates of the metho having been successfully practised on no less than four acres of Hop ground; to b delivered to the Society on or before th first Tuesday in February, 1823.

Preventing the Blight on Frui Trees and Culinary Plants.

37. To the person who shall discove to the Society the most effectual metho of preventing the Blight or ravages o Insects, on Fruit Trees and Culinar Plants, superior to any hitherto know or practised, and verified by actual and comparative experiments;—*the Gold Medal.*

The accounts, with proper certificates, to be delivered to the Society on or before the last Tuesday in February, 1823.

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7. Cattle and Sheep.

Feeding Cattle.

38. For the best experiments on Stall feeding Cattle (not fewer than five head), to be continued for the space of twelve months, in order to prove the earliest maturity and greatest propensity to fatten, of the most approved breeds of cattle in Great Britain, or Ireland, specifying the nature of the food

given, together with the daily consumption of each beast, with its weekly increase in weight, and such other observations as may be deemed of consequence;—*the Gold Medal.*

A full account of the methods employed, and of the expenses attending the same, and certificates of the sundry matters stated, to be produced on or before the second Tuesday in Feb. 1823.

Protecting Sheep.

39. To the person who shall communicate to the Society the best and cheapest method of protecting large flocks of sheep, not less than one thousand, from the inclemency of the weather during the winter months, particularly in mountainous districts where the practice of protecting sheep has not hitherto been adopted;—*the Gold Medal.*

A particular account of the experiments made, with the advantages arising therefrom, together with the expense, and certificates of its utility, to be produced to the Society on or before the first Tuesday in March, 1823.

N. B. It is required that the certificates shall specify the length of time the sheep were so protected, and the manner in which they were maintained during that time; together with the general method of managing them.

Cashmere Shawl-Goat.

40. To the person who shall have kept in a healthy state, in any part of the United Kingdom, during the last three years preceding the first of February, 1823, the greatest number of Cashmere Shawl-Goats;—*the Gold Medal.*

Certificates that at least five goats are in good health at the time of making the communication, together with full particulars of the method of treating them, to be produced to the Society on or before the first of March, 1823.

The same premium is extended to the year, 1824.

Cure of the Rot in Sheep.

41. To the person who shall discover to the Society the best and most effectual method of curing the Rot in Sheep, verified by repeated and satisfactory experiments;—*the Gold Medal.*

It is expected that the Candidates furnish accurate accounts of the symptoms and cure of the disease, together with the imputed cause thereof, and the actual or probable means of prevention, which, with proper certificates, must be delivered to the Society on or before the last Tuesday in February, 1823.

Preventing the ill-effects of Flies on Sheep.

42. To the person who shall discover to the Society the most effectual method of protecting sheep from being disturbed and injured by flies;—*the Silver Medal.*

It is required that the method be ascertained by repeated experiments, and that a certificate of its efficacy be delivered to the Society on or before the first Tuesday in February, 1823.

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9. Agricultural Machines.

Irrigation of Land.

43. To the person who shall discover to the Society the cheapest and most effectual method of raising water in quantities sufficient to be beneficially employed for the purpose of irrigating land, superior to and cheaper than any other method now in use;—*the Gold Medal,* or *Fifty Guineas.*

A model, on a scale of one inch to a foot, with certificates that a machine at large, on the same construction, has been used, specifying the quantity of water delivered in gallons per hour, and the height to which it is raised, to be produced to the Society on or before the first of March, 1823.

Paring Plough.

44. To the person who shall invent and produce to the Society a Machine or Plough for the purpose of paring land preparatory to burning, superior to any hitherto known or in use for such purpose, and to be worked by not more than one man and two horses;—*the Silver Medal,* or *Twenty Guineas.*

The machine and certificates that at least ten acres have been pared by it in a proper manner, to be produced to the Society on or before the first of February, 1823.

Dibbling Machine.

45. To the person who shall invent a machine, superior to any hitherto known or in use, to answer the purpose of

dibbling wheat, by which the holes for receiving the grain may be made at equal distances and proper depths;—*the Silver Medal*, or *Fifteen Guineas.*

The Machine, with certificates that at least three acres have been dibbled by it, to be produced to the Society on or before the second Tuesday in February, 1823.

Thrashing Machine.

46. To the person who shall invent a Machine by which corn of all sorts may be thrashed more expeditiously, effec tually, and at a less expense, than b any method now in use, and without in juring the straw more than thrashing b the flail;—*the Gold Medal.*

The Machine, or a Model, with prope certificates that such a Machine has bee usefully applied, that at least thirty quarter have been thrashed by it, and of the tim employed in the operation, to be produce to the Society on or before the last Tuesda in February, 1823.

PREMIUMS

FOR THE PRACTICAL APPLICATION OF DISCOVERIES AND IMPROVEMENTS IN

CHEMISTRY, DYEING, AND MINERALOGY.

Increasing Steam.

47. To the person who shall invent and discover to the Society a method, verified by actual experiment, of increasing the quantity or force of Steam in Steam Engines, with less fuel than has hitherto been employed, provided that in general the whole amount of the expenses in using steam engines may be considerably lessened;—*the Gold Medal*, or *Fifty Guineas.*

To be communicated to the Society on or before the last Tuesday in February, 1823.

Prevention of Smoke.

48. To the person who shall invent and produce to the Society the best and easiest means, superior to any now before the public, of preventing the emission of dense Smoke, from the chimnies of steam-engines, breweries, and manufactories;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the means proposed have been found to succeed in practice, to be produced to the Society on or before the first Tuesday in February, 1823.

Test for Arsenic.

49. To the person who shall discover to the Society a test for arsenic in solution, superior to any hitherto known;—*the Gold Medal.*

It is required that any communication i claim of this premium shall include method of detecting arsenic, not only in i usual form of white arsenic, or arseniou acid, but also in the state of arsenic aci and of the soluble salts formed by th combination of arsenious and arsenic acid with alkaline substances.

Claims for this premium to be delivere in on or before the last Tuesday in Feb ruary, 1823.

Preventing the Ill-Effects of Smelting Ores.

50. To the person who shall inven and discover to the Society the mos effectual method of preventing the ill effects arising to vegetation and anima life, from the sulphureous, arsenical, c other noxious fumes disengaged in smel ing the ores of Copper, Zinc, Lead, Tin Iron, &c. in the large way, and, if pos sible, of converting those pernicio fumes to useful purposes, in a manne superior to any hitherto known, or i use;—*the Gold Medal*, or *Fifty Guinea.*

It is required that a full account of th process employed, with certificates of i being successfully carried into effect, b produced to the Society on or before th first Tuesday in March, 1823.

Fine Bar Iron.

51. To the person who shall make the greatest quantity of Bar-iron, not less than ten tons, with coke, from coke pigs, equal in quality to the best iron imported from Sweden or Russia, and as fit for being converted into steel;—*the Gold Medal*, or *Fifty Guineas*.

Samples, not less than one quarter of a hundred weight, with certificates that the whole quantity is of equal quality, to be produced to the Society on or before the first Tuesday in March, 1823.

Refining Copper from the Ore.

52. To the person who shall discover to the Society a method of separating, purifying, and refining Copper from the Ore, so as to render it fit for those purposes to which fine copper is now applied, and by a process cheaper than and superior to any hitherto known or in use;—*the Gold Medal*, or *Fifty Guineas*.

Certificates that not less than three tons have been so prepared or refined, and a quantity not less than 14 lbs. of the copper so refined, to be produced to the Society on or before the last Tuesday in February, 1823.

Refining Zinc from the Ore.

53. To the person who shall invent and communicate to the Society a process of refining Zinc from the Ore superior to any hitherto known or in use, and fit for the purpose of making fine brass;—*the Gold Medal*, or *Fifty Guineas*.

Conditions the same as in the preceding premium.

Preparing Brass.

54. To the person who shall discover a method of making Brass from materials the produce of Great Britain or Ireland, of superior quality to that commonly manufactured in this country, and equal to foreign brass;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, and of the ingredients employed, together with their proportions, and certificates that one ton has been so manufactured, and a sample of the brass, not less than 14 lbs. to be produced to the Society on or before the last Tuesday in February, 1823.

Improved Earthenware Crucibles.

55. To the person who shall invent and discover to the Society a process for manufacturing earthenware crucibles which shall be capable of enduring higher degrees of heat than those now in use, and shall not be too expensive;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, and of the materials employed, with satisfactory certificates of the crucibles having been found to answer in use, and specimens of the crucibles, to be produced to the Society on or before the last Tuesday in March, 1823.

Preparation of Sulphuric Acid, from Sulphur, without the Use of any Nitric Salt.

56. To the person who shall prepare the largest quantity (not less than one ton) of Sulphuric Acid from sulphur, without any nitric salt, of a specific gravity not inferior to the best sulphuric acid of commerce;—*the Gold Medal*, or *Fifty Guineas*.

Certificates that not less than the above quantity of such an acid has been prepared, together with a sample, and a full account of the process employed, to be produced to the Society on or before the first Tuesday in February, 1823.

Purification of Coal Gas.

57. To the person who shall discover the cheapest method of purifying the inflammable gas procured from coal, superior to any method now in use;—*the Gold Medal*, or *Thirty Guineas*.

A full account of the process, with certificates of its fully answering the intended purpose, to be produced to the Society on or before the second Tuesday in February, 1823.

Refining Whale or Seal Oil.

58. For disclosing to the Society an effectual method of purifying Whale or Seal Oil from the glutinous matter that incrusts the wicks of lamps, and extinguishes the light, though fully supplied with oil; provided that such purified oil resists congelation in an equal degree with the unpurified;—*the Gold Medal*, or *Fifty Guineas*.

It is required that the whole of the process be fully and fairly disclosed, in order that satisfactory experiments may be made by the Society to determine the validity of the claim; and certificates that not less than twenty gallons have been purified according to the process delivered in, together with two gallons of the oil in its unpurified state, and two gallons so refined, to be produced to the Society on or before the second Tuesday in February, 1823.

Superior Oil for Chronometers and Watches.

59. To the person who shall invent and discover to the Society the best method of distinguishing the kind of oil fittest for chronometers and watches, ascertained by actual experiment; or for a superior method of rendering oil more fit for the above purpose than any hitherto in use, and particularly in rendering it less liable to become thick or rancid;—*the Gold Medal,* or *Fifty Guineas.*

A full account of the experiments and of the process or processes employed, verified by satisfactory certificates, together with a specimen of the oil, to be produced to the Society on or before the last Tuesday in March, 1823.

Crown Glass.

60. To the person who shall make Crown or Window Glass equally transparent, and as free from blue and green colour as the best German sheet;—*the Gold Isis Medal,* or *Thirty Guineas.*

Certificates that not less than two cwt. has been made, together with one whole plate and two of the largest squares that can be cut, and a full account of the proportions of the ingredients, and of the process of manufacture, to be produced to the Society on or before the last Tuesday in February, 1823.

Flint Glass.

61. To the person who shall make flint glass free from veins, and as dense and transparent as the best now in use, and quite fit for the purposes of Opticians;—*the Gold Medal,* or *Thirty Guineas.*

A full account of the process, with certificates that not less than two cwt. has been made, together with 20 lbs. in plates not less than six inches wide and three quarters of an inch thick, to be produced to the Society on or before the last Tuesday in January, 1823.

Indelible Ink.

62. To the person who shall discover to the Society a method of making a Black Ink proper for writing, superior to any at present known, indestructible by chemical applications, and not materially dearer than that which is now in common use;—*the Silver Medal,* or *Fifteen Guineas.*

Certificates that not less than two gallons of such ink have been actually prepared, and found to possess the qualities abovementioned, with a full detail of the process of making it, and two quarts of the ink, to be delivered to the Society on or before the second Tuesday in February, 1823.

Printers' Ink.

63. To the person who shall invent and discover to the Society the best composition for Printers' Ink, superior to any hitherto known or in use;—*the Gold Medal,* or *Thirty Guineas.*

Certificates that 112 lbs. of such ink have been made, with a full account of the process employed, and 6 lbs. of the ink, to be produced to the Society on or before the last Tuesday in February, 1823.

Copper Plate Printers' Ink.

64. To the person who shall invent and discover to the Society the best composition, superior to any hitherto known or in use, and fit for the finest kind of copper-plate printing;—*the Gold Medal,* or *Thirty Guineas.*

Certificates and conditions the same as for the last premium.

Rendering Leather Water-proof.

65. To the person who shall discover a method, superior to any now in use, and of moderate price, of rendering Leather Water-proof, without injuring its texture or pliability;—*the Silver Medal,* or *Fifteen Guineas.*

A full account of the process, and of the ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the leather in its unprepared and prepared state, to be produced to the Society on or before the last Tuesday in February, 1823.

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Hardening Tallow for Candles.

66. To the person who shall discover to the Society a method of hardening or otherwise preparing Tallow, so that candles may be made of it which will burn as clear and with as small a wick as wax candles, without running, and may be afforded at a less expense than any at present made with spermaceti;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that 112 lbs. of such tallow have been made into candles, and 12 lbs. of the candles made thereof, to be produced to the Society on or before the second Tuesday in February, 1823.

Preserving Seeds of Vegetables.

67. For the best method of preserving Seeds of Plants in a state fit for vegetation a longer time than has hitherto been practised, such method being superior to any known to the public, and verified by sufficient trial, to be communicated to the Society on or before the last Tuesday in December, 1823;—*the Gold Medal*, or *Thirty Guineas.*

Preserving Provisions from becoming rancid or rusty.

68. To the person who shall discover to the Society the best, cheapest, and most efficacious method of preserving Salted Provisions from becoming rancid or rusty;—*the Gold Medal*, or *Thirty Guineas.*

A full description of the method, with proper certificates that it has been found, on repeated trials, to answer the purpose intended, to be produced to the Society on or before the last Tuesday in February, 1823.

Preserving Iron from Rust.

69. To the person who shall invent and discover to the Society a cheap composition superior to any now in use, which shall effectually preserve Wrought Iron from rust;—*the Gold Medal*, or *Fifty Guineas.*

A full description of the method of preparing the composition, with certificates that it has stood at least two years unimpaired, being exposed to the atmosphere during the whole time, to be produced to the Society, with ten pounds weight of the composition, on or before the last Tuesday in January, 1823.

Preventing the Dry-rot in Timber.

70. To the person who shall discover to the Society a certain method of preventing the Dry-rot in Timber, superior to any hitherto known;—*the Gold Medal*, or *Thirty Guineas.*

The particulars of the method of prevention, confirmed by repeated experiments, to be produced to the Society on or before the last Tuesday in February, 1823.

Note.—For a method of curing and preventing the dry-rot in ship timber, see Mr. Bowden's communication in Vol. 36 of the Society's Transactions.

Preventing the Mildew in Paper.

71. To the person who shall communicate to the Society a process to be used in the manufacture of Paper, or some application to be made to manufactured paper, which shall effectually prevent it from becoming mildewed;—*the Gold Medal*, or *Thirty Guineas.*

A full account of the process or processes employed, with certificates and other evidence of their efficacy, to be communicated to the Society on or before the last Tuesday in March, 1823.

This premium is continued one year further on the same conditions.

Preventing the Destructive Effects from Moths.

72. To the person who shall discover to the Society a cheap, easy, and effectual method, verified by repeated and satisfactory trials, of preventing the destructive effects occasioned by Moths and other insects, in furs, woollens, and other articles, superior to any hitherto known or practised;—*the Gold Medal*, or *Thirty Guineas.*

The accounts, with proper certificates, to be produced to the Society on or before the first Tuesday in January, 1823.

Substitute for Lead Pipes.

73. To the person who shall invent and produce to the Society, a substitute for the Lead Pipes used for conveying malt and other liquors from the cellars to the bars of public-houses, superior to any other metal-pipes now in use;—*the Gold Medal*, or *Fifty Guineas.*

The substance of which the Pipe is made must be free from any poisonous or noxious quality, equally durable as lead, and of a moderate expense; and a specimen thereof, not less than ten yards in length, with a complete description of the process employed in forming it, must be produced to the Society on or before the last Tuesday in February, 1823.

Substitute for the Basis of White Paint.

74. To the person who shall produce to the Society the best substitute, superior to any hitherto known, for the basis of white paint, equally proper for the purpose as the white lead now employed; such substitute not to be of a noxious quality, and to be afforded at a price not materially higher than that of white-lead;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than 25 lbs. weight, with an account of the process used in preparing it, and certificates that at least one hundred weight has been manufactured, to be produced to the Society on or before the first Tuesday in February, 1823.

Substitute for Tar.

75. To the person who shall invent and discover to the Society the best substitute for Stockholm tar, equal in all its properties to the best of that kind, and prepared from materials the produce of the United Kingdom, or its colonies;—*the Gold Medal*, or *One Hundred Guineas.*

A quantity of the substitute, not less than one hundred weight, with certificates that at least one ton has been manufactured, and that it can be afforded at a price not exceeding that of the best foreign tar, together with an account of the process, to be delivered to the Society on or before the first Tuesday in March, 1823.

N. B. Tar is produced in Sweden and Norway from the roots of fir-trees burnt for that purpose.

Turpentine from the Scotch Fir, or Pinus Sylvestris.

76. To the person who shall prepare in Great Britain the greatest quantity of Turpentine, not less than two hundred weight, from that species of fir called the Scotch fir, or Pinus sylvestris, Linn.;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the Turpentine being prepared from such trees of British growth together with fifty-six pounds of the Turpentine, to be delivered to the Society on or before the second Tuesday in March 1823.

77. For the next greatest quantity prepared, not less than one hundred weight, on similar conditions;—*the Silver Medal*, or *Twenty Guineas.*

N. B. The Society being in possession of the method practised for extracting Turpentine from trees whilst growing, and of samples so procured, information will be given upon that subject, on application for that purpose, at the Society's house.

Preparation of Tan.

78. To the person who shall prepare, in the most concentrated form, so as to be easily portable, and at a price applicable to the purposes of manufacturers, the largest quantity, not less than one hundred weight, of the astringent principle called Tannin, which abounds in oak bark, and in many other vegetable substances;—*the Gold Medal*, or *Fifty Guineas.*

Certificates of the good quality of the article so prepared, and a sample of not less than 28 lbs. to be produced to the Society on or before the last Tuesday in February, 1823.

Dyeing Silk of a Pink or Rose Colour.

79. To the person who shall invent and discover to the Society, a process of dying Rose and Pink colours in Silks, without the use of Safflower, by a substitute of British or colonial growth, which shall produce a colour equally beautiful and permanent, and at an expense not more than two-thirds of the current price;—*The Gold Medal*, or *Thirty Guineas.*

The communication, with a full account of the processes employed, and certificates that the required conditions are accomplished, to be produced to the Society on or before the last Tuesday in March, 1823.

Dyeing Silk or Woollen.

80. To the person who shall discover a method of dyeing Silk or Woollen, of any colour, superior to the same produced by other British dyers, and equal

to those produced by the Continental dyers;—*the Gold Medal,* or *Thirty Guineas.*

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk and woollen in its undyed and dyed state, to be produced to the Society on or before the first Tuesday in March, 1823.

Improved Black Dye for Silk or Wool.

81. To the person who shall invent and discover to the Society a black dye for silk or wool superior in colour and durability to any at present in use;—*the Gold Medal,* or *Fifty Guineas.*

This premium is more immediately intended for the improvement of those colours known by the name of blue blacks.

A full account of the process and ingredients employed, together with their proportions, attested by satisfactory certificates, as well as samples of the silk or wool so dyed, to be produced to the Society, on or before the last Tuesday in March, 1823.

Dyeing with Lac Lake.

82. To the person who shall invent and discover to the Society a process for dyeing silk, wool, or cotton with lac lake, superior to any now in use;—*the Gold Medal,* or *Thirty Guineas.*

A full account of the process, with certificates that it has been found to answer completely in use, and specimens of articles so dyed, to be produced to the Society on or before the last Tuesday in March, 1823.

Preparation of a Red Stain for Cotton Cloth.

83. To the person who shall communicate to the Society the most effectual method of printing or staining cotton cloth with a red colour, by an immediate application of the colouring matter to the cloth, equally beautiful and durable with the red colours now generally procured from decoctions of madder;—*the Gold Medal,* or *Fifty Guineas:*

Certificates that the process has been advantageously used on ten pieces of calico, each twenty-one yards or upwards in length; one piece of the calico so printed, one pound of the colour, and a full account of the preparation and application thereof, to be produced to the Society on or before the second Tuesday in February, 1823.

Preparation of a Green Colour for printing Cotton Cloth.

84. To the person who shall communicate to the Society the best method of printing with a full green colour on cotton cloth, by an immediate application of the colouring matter from a wooden block to the cloth, equally beautiful and durable as the colours now formed from the complicated process of the decoction of weld, and the solutions of indigo;—*the Gold Medal,* or *Fifty Guineas.*

Certificates and conditions as for Premium 83.

Permanent White Paint for the Use of Artists.

85. To the person who shall produce to the Society a White Paint for oil, superior to any hitherto known, and not liable to be discoloured by exposure to light or to sulphuretted hydrogen gas;—*the Gold Medal,* or *Thirty Guineas.*

A full account of the process, and 1 lb. of the colour to be produced to the Society, on or before the second Tuesday in February, 1823.

Red Pigment.

86. To the person who shall discover to the Society a full and satisfactory process for preparing a Red Pigment, fit for use in oil or water, equal in tone and brilliancy to the best carmines and lakes now known or in use, and perfectly durable;—*the Gold Medal,* or *Fifty Guineas.*

One pound weight of such colour, and a full disclosure of its preparation, to be produced to the Society on or before the first Tuesday in February, 1823.

N. B. It is required, that the colour should remain unaltered by common exposure to strong light, damps, and noxious vapours.

Ultramarine.

87. To the person who shall prepare an artificial Ultramarine, equal in colour, brilliancy, and durability, to the best

prepared from lapis lazuli, and which may be afforded at a cheaper rate;—*the Gold Medal,* or *Thirty Guineas.*

The conditions are the same as in the preceding premium for the red pigment.

Colourless Lac Varnish.

88. To the person who shall produce to the Society a Lac Varnish equally hard with that made from shell or seed lac, and as fit for use in the arts, but deprived of its colouring matter;—*the Gold Medal,* or *Thirty Guineas.*

A full account of the process, and one quart of the varnish to be produced to the Society on or before the second Tuesday in January, 1823.

Statuary Marble.

89. To the person who shall discover within Great Britain or Ireland, a quarry of White Marble fit for the purposes of statuary, and equal to those kinds now imported from Italy;—*the Gold Medal,* or *One Hundred Guineas.*

A block of at least three feet in length, two in height, and two in width, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the first Tuesday in February, 1823.

N. B. In order to prevent useless expense or trouble to the Claimant in forwarding so large a block, the Society will be ready to examine any smaller specimen of the marble, and will express their opinion of its value to the Candidate before the block required by the above premium is produced.

Stone for Lithography.

90. To the person who shall discover within Great Britain or Ireland, a quarry of Stone fit for the purposes of Lithography, equal at least to the stones imported from abroad;—*the Gold Isis Medal,* or *Thirty Guineas.*

A specimen of the stone at least two feet square and two inches in thickness, with an account of the situation of the quarry, and certificates of its possessing considerable extent, to be produced to the Society on or before the last Tuesday in February, 1823.

Mineralogical and Geological County Maps.

91. To the person who shall complete and publish the best Mineralogical and Geological Map of any County in the United Kingdom, on a scale of not less than one inch to a mile, containing an account of the situation of the different mines therein, and describing the kinds of minerals thence produced, with sections of the strata;—*the Gold Medal,* or *Fifty Guineas.*

Certificates of the accuracy of such maps, together with the maps, to be produced to the Society on or before the first Tuesday in February, 1823. The maps to remain the property of the Society.

Mineralogical and Geological Map of Ireland.

92. To the person who shall complete and publish an accurate Mineralogical and Geological Map of Ireland, on a scale of not less than five miles to an inch, containing particulars described in the foregoing premium;—*the Gold Medal,* or *Fifty Guineas.*

The conditions are the same as in the preceding.

Mineralogical and Geological Map of Scotland.

93. The same premium is offered for a Mineralogical and Geological Map of Scotland, on similar conditions.

Natural History.

94. To the author who shall publish the Natural History of any county in the United Kingdom;—*the Gold Medal,* or *Fifty Guineas.*

It is required that the several natural productions, animal, vegetable, and mineral, peculiar to the county, or found therein, be carefully and scientifically arranged and described, in order that the public may be enabled to judge what arts or manufactures are most likely to succeed in such county. A copy of the work to be delivered to the Society on or before the last Tuesday in February, 1823, to remain the property of the Society.

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PREMIUMS IN POLITE ARTS.

Honorary Premiums for Nobility.

To Gentlemen *under the Age of Twenty-five, Sons or Grandsons of Peers or of Peeresses in their own right of the United Kingdom.*

95. For the best original painting or drawing of an historical subject;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

96. For the best copy of an historical subject;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

97. For the best original painting or drawing of a portrait;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

98. For the best copy of a portrait;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

99. For the best original painting or drawing of a landscape;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

100. For the best copy of a landscape;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

101. For the best original painting or drawing of flowers or fruit;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

102. For the best copy of fruit or flowers;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

103. For the best original Painting or drawing of still-life;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

104. For the best copy of still-life;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

To Ladies *under the Age of Twenty-five, Daughters or Grand-daughters of Peers or of Peeresses in their own right of the United Kingdom.*

105. For the best original painting or Drawing of an historical subject;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

106. For the best copy of an historical subject;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

107. For the best original painting or drawing of a portrait;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

108. For the best copy of a portrait;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

109. For the best original painting or drawing of a landscape;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

110. For the best copy of a landscape;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

111. For the best original painting or drawing of flowers or fruit;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

112. For the best copy of flowers or fruit;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

113. For the best original painting or drawing of still-life;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

114. For the best copy of still-life;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

Honorary Premiums for Gentlemen and Ladies.

To Gentlemen *under the Age of Eighteen.*

115. For the best drawing in chalk, pencil, or Indian ink, being a copy from any picture, print, or drawing of a head or figure;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

To Gentlemen *under the Age of Twenty.*

116. For the best drawing in chalk, pencil, or Indian ink, from a bust;—*the*

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Silver Medal; for the next in merit, *the Silver Isis Medal.*

To GENTLEMEN *under the Age of Twenty-one.*

117. For the best drawing in chalk, pencil, or Indian ink, from a statue or cast in plaster, of an entire figure;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

118. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours of an historical subject, being a copy;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

119. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours of a portrait, being a copy;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

120. For the best drawing in pencil, Indian ink, or chalk, or painting in water colours, of a landscape, being a copy;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

121. For the best drawing in pencil, Indian ink, or chalk, or painting in water colours of flowers or fruit, being a copy;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

122. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours of still-life, being a copy;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

123. For the best copy in oil colours of an historical subject;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

124. For the best copy in oil colours of a portrait;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

125. For the best copy in oil colours of a landscape;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

126. For the best copy in oil colours of flowers or fruits;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

127. For the best copy in oil colours of still-life;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

To GENTLEMEN *under the Age of Twenty-five.*

128. For the best original drawing or painting in water-colours of an historical subject;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

129. For the best original drawing or painting in water-colours of a portrait;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

130. For the best original drawing or painting in water-colours of a landscape;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

131. For the best original drawing or painting in water-colours of flowers or fruit;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

132. For the best original drawing or painting in water-colours of still-life;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

133. For the best original painting in oil colours of an historical subject;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

134. For the best original painting in oil colours of a portrait;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

135. For the best original painting in oil colours of a landscape;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

136. For the best original painting in oil colours of flowers or fruit;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

137. For the best original painting in oil colours of still-life;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

To LADIES *under the Age of Eighteen.*

138. For the best drawing in pencil, Indian ink, or chalk, being a copy, from any picture, print, or drawing, of a head or figure;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

To LADIES *under the Age of Twenty.*

139. For the best drawing in pencil, Indian ink, or chalk, from a bust;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

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To LADIES *under the Age of Twenty-one.*

140. For the best drawing in pencil, Indian ink, or chalk, from a statue or cast in plaster, of an entire figure;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

141. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours, being a copy, of an historical subject;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

142. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours, being a copy, of a portrait;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

143. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours, being a copy, of fruit or flowers;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

144. For the best drawing in pencil, Indian ink, or chalk, or painting in water-colours, being a copy, of still-life;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

145. For the best copy in oil colours of an historical subject;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

146. For the best copy in oil colours of a portrait;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

147. For the best copy in oil colours of a landscape;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

148. For the best copy, in oil colours, of fruit or flowers;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

149. For the best copy, in oil colours, of still-life;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

To LADIES *under the Age of Twenty-five.*

150. For the best original drawing or painting in water-colours of an historical subject;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

151. For the best original drawing or painting in water-colours of a landscape;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

152. For the best original drawing or painting, in water-colours, of fruit or flowers;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

153. For the best original drawing or painting, in water-colours, of still-life;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

154. For the best original painting in oil colours of an historical subject;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

155. For the best original painting in oil colours of a portrait;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

156. For the best original painting in oil colours of a landscape;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

157. For the best original painting in oil colours of fruit or flowers;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

158. For the best original painting in oil colours of still-life;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

N. B. As the foregoing honorary premiums are intended only for the nobility and gentry; persons professing any branch of the polite arts, or any business dependent on the arts of design, or the sons and daughters of such persons, will not be admitted candidates in the above classes.

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PREMIUMS FOR ARTISTS AND OTHERS.

Human Figure.

159. For the best drawing in chalk, pencil, or Indian ink, copied from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

160. For the best outline, drawn from any entire figure of the antique, or cast in plaster—the size of the drawing to be not less than twenty-four inches, to be accompanied with the drawing of a hand and foot, the size of life—by persons under the age of eighteen;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

191. For the best finished drawing from any entire antique figure, or from any cast in plaster—the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot, the size of life, by persons under the age of nineteen;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

162. For the best finished drawing of an entire anatomical human figure, from a model or cast—the size of the drawing to be not less than twenty-four inches, to be accompanied with a drawing of a hand and foot, the size of life, by persons under the age of nineteen;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

163. For the best drawing, from the living figure—the size of the drawing to be not less than twenty-four inches, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

164. For the best copy in water-colours from any picture, being a composition of two or more figures, the size of the principal figure not less than nine inches, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

165. For the best original drawing, being a composition of two or more figures, the principal figure not less than nine inches, by persons under the age of twenty-five;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

166. For the best copy in oil from any picture, being a composition of two or more figures, the principal figure not less than twenty-four inches, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

167. For the best original painting, being an historical composition, of two or more figures, the subject taken from Homer's Iliad, the principal figure not less than twenty-four inches, by persons under the age of twenty-five;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

168. For the best original painting in oil, being a composition of two or more figures, the principal figure not less than twenty-four inches, by persons under the age of twenty-five;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

Heads or Portraits.

169. For the best drawing of a head, copied from any picture, drawing, or print, by persons under the age of sixteen;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

170. For the best finished drawing of a head, not less than the size of life, from any bust, by persons under the age of eighteen;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

171. For the best original painting in water-colours of a portrait, or group of portraits, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

172. For the best copy, in oil, of a portrait, by persons under the age of nineteen;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

173. For the best original painting in oil of a portrait, by persons under the age of twenty-three;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

Models.

174. For the best model in bass-relief, from any entire antique figure, or cast in plaster, the size of the model not less

than twenty-four inches, by persons under the age of eighteen;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

175. For the best model in bass-relief from the living figure, by persons under the age of twenty-one, the model not less than twenty-four inches;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

176. For the best model of a bust from the antique, of a different size from the original, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

177. For the best model of a bust from nature, of the size of life, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

178. For the best model in the round from an entire antique figure, the model not less than twenty-four inches high, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

179. For the best original model of a group, the figures not less than twenty-four inches, by persons under the age of twenty-five;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

180. For the best anatomical model of a dissected limb, or other part of the human body, natural or morbid, in wax or other substance;—*the Gold Medal.*

Landscape.

181. For the best drawing of a landscape, copied from any picture, drawing, or print, by persons under the age of eighteen;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

182. For the best original drawing of a landscape from nature, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

183. For the best original oil painting of a landscape from nature, by persons under the age of twenty-three;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

184. For the best original composition of a landscape painted in oil, by persons under the age of twenty-five;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

185. For the best original marine painting, in oil, of two or more vessels, by persons under the age of twenty-five;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

Flowers, or Fruit.

186. For the best drawing from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

187. For the best original composition in water-colours drawn from nature, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

188. For the best original composition in oil, painted from nature, by persons under the age of twenty-five;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

Animals.

189. For the best drawing of any animal, copied from any picture, print, or drawing, by persons under the age of sixteen;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

190. For the best original drawing from nature of any animal, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

191. For the best original painting of a group of not less than three animals painted from nature, by persons under the age of twenty-five;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

Still-Life.

192. For the best original composition, painted in oil or water-colours, of three or more of such subjects as are usually called Still-Life, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

Other Subjects.

193. For the best original painting, in oil, not included in any of the other

classes;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

194. For the best original painting in water-colours, not included in any of the other classes;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

195. For the best original drawing, not included in any of the other classes;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

196. For the best painting, in oil, being a copy, not included in any of the other classes;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

197. For the best painting in water-colours, being a copy, not included in any of the other classes;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

198. For the best drawing, being a copy, not included in any of the other classes;—*the Silver Isis Medal;* for the next in merit, *the Silver Palette.*

199. For the best design for a vignette to be printed at the head of the Society's letters, &c.;—*the Gold Isis Medal.*—The design to remain the property of the Society.

Architecture.

200. For the best perspective drawing of a Corinthian capital, not less than eighteen inches high, by persons under twenty-one years of age;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

201. For the best original design in Greek architecture, for a building adapted to the purposes and site of the British Museum; consisting of plan, elevation, section, and perspective view, to the scale of 1-16th of an inch to a foot; the drawing to remain the property of the Society, if required, by persons under the age of twenty-five;—*the Gold Medallion;* for the next in merit, *the Gold Isis Medal.*

The following inscription to be engraved on the medallion: "*The Premium given by the Society for the encouragement of Arts, Manufactures, and Commerce, in conformity to the will of John Stock, esq. of Hampstead.*"

Perspective.

202. For the best perspective drawing from any public building in the United Kingdom, from elevations taken by actual measurement, and projected according to rule, drawn on large elephant paper, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

203. For the best perspective drawing of machinery, by persons under the age of twenty one, *the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

Enamel Painting.

204. For the best enamel painting of a head, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

205. For the best historical painting in enamel, by persons under the age of twenty-five;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

Carving in Wood.

206. For the best carving in Wood, of fruit, or flowers, not less than nine inches high, by persons under the age of twenty-one;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

207. For the best carving in Wood, of one or more animals, the size of the animal not less than six inches, by persons under the age of twenty-three;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

208. For the best carving in Wood, of one or more human figures, not less than a foot in height, by persons under the age of twenty-five;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

Etching.

209. For the best free Etching in historical composition, from a picture of eminence;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

210. For the best free Etching of a landscape, from a picture of eminence;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

Finished Engravings.

211. For the best finished Engraving in historical composition;—*the Gold Medal;* for the next in merit, *the Gold Isis Medal.*

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212. For the best finished engraving of a landscape;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

213. For the best finished engraving of a portrait;—*the Gold Isis Medal;* for the next in merit, *the Silver Medal.*

214. For the best finished engraving of a portrait in Mezzotinto;—*the Silver Medal.*

215. For the best finished engraving not included in any of the preceding classes;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

N. B. In the class of finished engravings the Society requires an aquafortis impression, and a finished proof, to be sent, and to remain with the Society.

Engraving on Steel.

216. For the best specimen of engraving on a steel plate not less than 5 inches by 3 inches in area, and not exceeding ¼th of an inch in thickness; the plate to be afterwards hardened without injuring the engraving;—*the Gold Medal.*

The Plate, with two impressions from it, both in its soft and hardened state, to be produced to the Society. The impressions, but not the plate, to remain the property of the Society.

Engraving on Wood or Metal Blocks.

217. For the best Engraving on Wood or Metal Blocks, of an historical subject, the size of the principal figure not less than six inches in height, and the Block to be at least twelve inches by nine;—*the Gold Isis Medal.*

Two or more impressions, with the Block, to be produced to the Society. The impressions, but not the block, to remain the property of the Society.

Prevention of Forgery.

218. To the person who shall communicate to the Society the best method of preventing the impressions of prints from being transferred from the paper to plates or blocks for the purpose of being etched or engraved;—*the Gold Isis Medal,* or *Thirty Guineas.*

The communication, with a full description of the process, and of the materials employed, together with the specimens, to be sent to the Society on or before the last Tuesday in February, 1823.

As this premium is intended to increase the difficulty of forging Bank Notes, and other kinds of paper currency, it is required, that the process shall not be too difficult or expensive for general use.

Lithography.

219. For the best specimen in this art;—*the Silver Medal.*

A particular account of the process employed, with six impressions of the drawing, to be produced to the Society.

Medal Die Engravings.

220. For the best Die Engraving either of a single figure or group, after the engraver's own design and model;—*the Gold Medal.*

221. For the best Die Engraving of a head;—*the Gold Isis Medal.*

The Dies, with two impressions or casts, and the model, in each claim for Medal Die sinking, are to be produced to the Society, and the impressions or casts to remain the property of the Society.

222. To the person who shall discover and communicate to the Society a method of hardening Medal Dies, superior to any hitherto known, and which shall completely prevent the surface of the die from being cracked, scaled, warped, or otherwise injured;—*the Gold Medal,* or *Thirty Guineas.*

A full detailed account of all the processes required to produce the effect, with certificates of their successful application, to be delivered to the Society on or before the first Tuesday in March, 1823.

Premium for Medical or Surgical Students.

223. For the best Original Drawing (made from actual dissection), of the anatomy of the human body, or of any part thereof, sufficiently full and accurate for the purposes of Surgery; such drawing to be not less than the natural size of the parts; by persons under the age of twenty-two;—*the Silver Medal;* for the next in merit, *the Silver Isis Medal.*

It is required that each drawing be accompanied by an outline, with the necessary references to render the drawing intelligible.

Conditions for the Polite Arts.

All performances in the class of Polite Arts, whether for claims or bounties, are to be produced to the Society on or before the first Tuesday in March, 1823, and none can be received after that day.

No Candidate, under any pretence whatever, shall be allowed to retouch or varnish a performance after it has been received by the Society.

No person having received a premium or bounty, shall afterwards receive an equal or inferior one in the same department of art.

No more than one performance in each class shall be received from the same Candidate.

All performances to which premiums or bounties are adjudged, shall remain with the Society until after the second Wednesday in June, 1823, when they will be re-delivered, unless mentioned in the premiums to the contrary.

No performance shall be admitted, that has obtained a reward from any other society, or academy.

All performances must have been executed within the year previous to their being sent in to the Society.

No performance can be received with a view to obtain a bounty, which could have come into any of the foregoing classes.

It is required, that the subjects for which premiums are offered, be delivered in without the names, or any external intimation to whom they belong; that the claimant affix on the front of his performance whatever mark he pleases, and that the same mark be inscribed on the outside of a paper sealed up, containing within the name and residence of the Candidate, and *on the outside* the age and sex, and the number of the premium in claim of which the performance is offered; the name not to be disclosed unless the Candidate be successful, or in consequence of a special vote of the Society, or Committee.

To encourage real merit, and to prevent attempts to impose on the Society, by producing drawings made or retouched by any other person than the Candidate, the Society require a specimen of the abilities of each successful candidate to be made under the inspection of the Committee of Polite Arts.

All Candidates in the Polite Arts are required to signify on their drawings, whether the performances are originals or copies; and if possible to send the originals from which the copies are taken.

All copies of drawings, &c. are to be on a different scale from the original.

The Society reserve to themselves the power of giving a Medal of less value than the premium offered, or of withholding the same altogether in cases where the performance shall be deemed undeserving of reward.

In consideration of the great number of premiums here offered, embracing so many departments of the Fine Arts, no bounty will be given to any performance comprised in any of the preceding classes.

PREMIUMS FOR ENCOURAGING AND IMPROVING MANUFACTURES.

Sheep's Wool.

224. To the person who shall prove to the Society, that he has sold the largest quantity of Merino Wool, or such Wool as will answer the same purpose, being the produce of his own flock, in the United Kingdom, for the purpose of being manufactured into superfine cloth, the quantity of Wool not less than five hundred weight, in the year 1822;—*the Gold Medal.*

Certificates, along with samples of the wool, and of the cloth manufactured from it, to be produced to the Society on or before the last Tuesday in March, 1823.

225. For the next greatest quantity, not less than two hundred and fifty pounds;—*the Silver Medal,* on similar conditions.

Wicks for Candles.

226. To the person who shall make known to the Society the most satisfactory result of a series of experiments actually made by him to determine the best thickness of Cotton Wicks for Candles, so as to obviate the defects of those commonly used;—*the Silver Medal,* or *Ten Guineas.*

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Certificates, that not less than one hun-

dred weight have been so made, and six pounds of the Candles, to be produced to the Society, on or before the last Tuesday in February, 1823.

N. B. The intention in offering this premium is, to ascertain the proper thickness or bulk of the wick in proportion to that of the tallow, and to remove the unpleasant consequences and waste arising from the sparkling, or guttering of the candles in common use.

Transparent Paper.

227. To the person who shall discover to the Society a method of making Paper from the pulp, that shall be perfectly transparent, and that shall take and bear common writing-ink with the same facility and correctness as writing-paper generally in use;—*the Silver Medal*, or *Twenty Guineas.*

Certificates of the making such paper, an account of the process, and one ream of the paper, to be produced on or before the second Tuesday in March, 1823.

[China Paper, see page xxxiv.]

Gloves.

228. To the person who shall make known to the Society a process equal or superior to that of the French, for preparing, dyeing, and finishing the skins, verified by actual experiments, and the communication accompanied with at least a dozen pair of gloves made from skins so prepared;—*the Gold Medal*, or *Forty Guineas.*

Certificates from competent persons, fully approving of the result of such experiments, together with the gloves and communication, to be produced to the Society on or before the last Tuesday in March, 1823.

Cat-gut.

229. To the person who shall discover to the Society the best method of manufacturing, in the United Kingdom of Great Britain and Ireland, the intestines of sheep, lambs, goats, or of any other animals, into the article called Cat-gut, equally strong, clear, smooth, even, and free from knots, as the best Italian strings, and at a price not exceeding what they are usually sold for in England;—*the Gold Medal*, or *Thirty Guineas.*

Certificates that not less than fifty pound weight have been so prepared by the claimant, with a full detail of the process, and samples of the articles of various thicknesses, to be produced to the Society on or before the first Tuesday in February, 1823.

230. For the next greatest quantity, not less than twenty-five pounds;—*the Silver Medal*, or *Twenty Guineas*, on similar conditions.

Hose for Fire Engines, Brewhouses, &c.

231. To the person who shall invent and make known to the Society a method of making Hose for Fire Engines, Brewhouses, &c. similar to those used on the continent, made of flax or hemp, or other flexible material cheaper than leather;—*the Gold Isis Medal*, or *Thirty Guineas.*

A full account of the process used in manufacturing it, with certificates of its efficacy in practice, to be produced to the Society on or before the last Tuesday in February, 1823.

Thread for Lace.

232. To the person who shall invent and discover to the Society a method of manufacturing Thread from flax, of as fine quality as any used on the Continent;—*the Gold Medal*, or *Thirty Guineas.*

Samples of the Thread, not less than one pound in weight, and of the Lace made therefrom, together with certificates that not less than ten pounds in weight of each sort has been manufactured, to be produced to the Society, on or before the last Tuesday in March, 1823.

233. To the person who shall invent and produce to the Society the best imitation of Indian Shawls, made from real Cachemire Wool, without any mixture of silk or other article;—*the Gold Medal*, or *Thirty Guineas.*

Certificates from competent persons approving the articles manufactured, with a full account of the process employed therein, to be produced to the Society on or before the last Tuesday in March, 1823.

Cloth from New South Wales Wool.

234. To the person who shall manufacture the finest specimen, at a fair market price, of Cloth from wool imported from New South Wales, not less than 35 yards, without any admixture of other wool;—*the Gold Isis Medal.*

Certificates from competent persons ap-

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proving of the article so manufactured, with a full account of the process employed therein, to be produced to the Society on or before the last Tuesday in February, 1823.

Organzine Silk.

235. To the person who shall invent and produce to the Society a method by which to organzine silk equal in quality to the Italian throw, at an expense not more than two-thirds of the current price of throwing;—*the Gold Medal,* or *Fifty Guineas.*

The communication, with a full description of the process, and models or drawings of the apparatus employed, and samples of the produce, with certificates of the invention answering the required conditions, to be produced to the Society on or before the second Tuesday in March, 1823.

Machine for Silk Weaving.

236. To the person who shall invent and produce to the Society a Machine to weave figured silks, for garments, shawls, handkerchiefs, &c. of patterns equally fine and rich as those now made in France, at less expense than the montures, &c. now in use, also affording greater facility for changing the pattern, and requiring less manual labour in working;—*the Gold Medal,* or *Fifty Guineas.*

Certificates of the performance of the Machine, and a model of the same, to be produced to the Society on or before the last Tuesday in March, 1823.

Preventing the Watering of Plain Silks.

237. To the person who shall invent a method of preventing Plain Silks from being watered in the loom, without the use of a knee-roll;—*the Silver Medal,* or *Fifteen Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the last Tuesday in March, 1823.

Weaving Ribbons in the Single Hand Loom.

238. To the person who shall produce the best substitute for the plan now used in the Single-Hand Loom, namely, High-lashes and Pass-cords;—*the Gold Isis Medal,* or *Twenty Guineas.*

The improved plan to be capable of producing ribbons equal in texture to those of French manufacture, and to perform well in every respect. The entire height of the Loom and its appendages not to exceed eight feet. The communication, together with specimens of ribbons made with the improved Loom, to be produced to the Society on or before the first Tuesday in March, 1823.

PREMIUMS IN MECHANICS.

Gunpowder Mills.

239. To the person who shall invent and discover to the Society the most effectual mode of preventing explosions in Gunpowder Mills;—*the Gold Medal,* or *One Hundred Guineas.*

Certificates and accounts of the method having been put in practice in one or more Gunpowder Mills in this kingdom, and that it promises, in the opinion of the best judges concerned in such works, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in February, 1823.

N. B. As an encouragement to persons to turn their thoughts to improvements of this nature, if any should be made on the present method of conducting the business of Gunpowder-making which fall short of the total prevention of explosion; such bounty or reward will be bestowed on them as they may appear to merit.

Family or Portable Mill.

240. To the person who shall invent and produce to the Society, a mill for Grinding Corn for the use of private families, or parish poor; the construction to be simple, the mill to be easily

worked, and superior to any hitherto in use;—*the Gold Medal*, or *Thirty Guineas.*

The Mill, and certificates of its having been used to good effect, to be produced to the Society, on or before the last Tuesday in February, 1823. Cheapness and simplicity will be considered as essential parts of its merit; and the Mill, or a model, to remain with the Society.

Machine for Raising Coals, Ore, &c. &c.

241. To the person who shall invent and produce to the Society a machine for raising coals, ore, &c. from mines, superior to any hitherto known or in use; and which shall produce the effect at less expense;—*the Gold Medal*, or *Fifty Guineas.*

A model, with a certificate that a machine at large on the same construction has been advantageously used, to be produced to the Society on or before the second Tuesday in February, 1823.

Improved Walking-wheel, or Crane.

242. To the person who shall invent an improved Walking Wheel or Crane, on which the weight or power of any person or persons shall be applied with the greatest safety and effect, and so contrived that the power can be varied according to the greater or less weight to be raised or lowered;—*the Gold Medal*, or *Thirty Guineas.*

A model, with a certificate that the machine at large has been employed to good effect, to be produced to the Society on or before the second Tuesday in March, 1823.

Machine for Raising Water.

243. To the person who shall invent a machine on a better, cheaper, and more simple construction than any hitherto known for raising water out of wells, &c. from a depth of not less than fifty feet;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the performance of the machine, and a model of it, to be produced to the Society, on or before the last Tuesday in February, 1823.

Extinguishing Fires.

244. To the person who shall produce to the Society a method for preventing or extinguishing fire in buildings, superior to any now in use;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the last Tuesday in January, 1823.

This Premium is offered in compliance with a recommendation in the will of the late Dr. Anthony Fothergill.

Boring and Blasting Rocks.

245. To the person who shall discover to the Society a more simple, safe, cheap, and expeditious method than any hitherto known or in use, of Boring or Blasting Rocks in mines, shafts, wells, &c.;—*the Gold Medal*, or *Thirty Guineas.*

Certificates of the method having been practised with success, with a full description thereof, to be delivered to the Society on or before the first Tuesday in February, 1823.

Heating Rooms for the purpose of Manufacturers.

246. To the person who shall invent and discover to the Society, a method of Heating Rooms, superior to and cheaper than any hitherto known or in use, for the purpose of manufacturers;—*the Gold Medal*, or *Thirty Guineas.*

A model or complete drawing and description of the method, with certificates that it has been successfully practised, to be delivered to the Society on or before the last Tuesday in March, 1823.

Improved Ventilation.

247. To the person who shall invent and produce to the Society a mode of permanently Ventilating the apartments in hospitals, workhouses, and other crowded places, superior to any now known or used;—*the Gold Medal*, or *Fifty Guineas.*

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates to be delivered to the Society on or before the last Tuesday in February, 1823.

Ventilating Coal Mines.

248. To the person who shall invent and carry into practice a method of Ven-

tilating Coal Mines so as effectually to prevent the accidents liable to arise from the accumulation of carburetted hydrogen and other gases;—*the Gold Medal*, or *Fifty Guineas*.

A full account of the process, with certificates of its efficacy, to be produced to the Society on or before the last Tuesday in February, 1823.

N. B. The Society will be very glad to attend to any communication, which, though not completely effecting the object, appears to offer an approximation to it. The Society wish particularly to refer candidates for this premium to the communication made by Mr. Ryan, and published in the 34th vol. of the "Transactions," and will consider themselves obliged to any person who will furnish any information with respect to the attempts which have been made to introduce Mr. Ryan's mode of ventilating coal mines into actual use, and of the success with which this method has been attended.

Preventing Accidents from Stage Coaches.

249. To the person who shall invent and discover to the Society a method of preventing accidents arising from Stage Coaches;—*the Gold Medal*, or *Thirty Guineas*.

Ample certificates of its efficacy, and a description of the method with models of the machinery used, to be produced to the Society on or before the last Tuesday in February, 1823.

N. B. The Society wish to impress strongly on the public the necessity of turning their attention to the above premium, from the number of accidents that daily occur; and suggest whether they might not, in some degree, be prevented, by an alteration in the manner of placing the luggage.

Preventing Accidents from Horses Falling with Two-Wheeled Carriages.

250. To the person who shall invent and produce to the Society a method, superior to any hitherto known or in use, of preventing accidents from the falling of Horses with Two-wheeled Carriages, especially on steep declivities;—*the Gold Medal*, or *Thirty Guineas*.

A model of the apparatus, and a full account of the means by which the effect has been produced, with proper certificates that the same has been used with success, to be delivered to the Society, on or before the second Tuesday in February, 1823.

Improving Turnpike and other Roads.

251. To the person who shall discover to the Society the most effectual and cheapest method, verified by actual experiment, of combining the materials ordinarily employed in making or repairing Roads, so as to form them of the hardest consistency by their cementing properties, or by an artificial mixture of earth, stones, &c. altered by heat, or any other mode, so as to form an even, hard, and durable carriage-road;—*the Gold Medal*, or *Thirty Guineas*.

It is required that an accurate account of the method used, and every expense attending it, together with satisfactory certificates of its being effectual, be delivered to the Society on or before the first Tuesday in March, 1823.

Raising the Bodies of Persons who have Sunk under Water.

252. To the person who shall invent and produce to the Society, a cheap and portable Drag, or other machine, superior to those now in use, for the purpose of taking up, in the best and most expeditious manner, and with the least injury, the bodies of persons who have sunk under water;—*the Gold Medal*, or *Thirty Guineas*.

The drag or machine, to answer the purpose intended, to be produced to the Society on or before the first Tuesday in March, 1823.

Preventing prejudicial effects to the Persons employed in Dry-grinding.

253. To the person who shall invent and produce to the Society a mode of obviating the prejudicial effects that attend the operation of Pointing Needles, and other branches of Dry-grinding, during which the particles of grindstone-dust, steel, and iron, being thrown into the air, and received with it into the lungs, occasion asthma, consumption, and other painful disorders;—*the Gold Medal*, or *Thirty Guineas*.

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A model of the apparatus, and a full account of the means by which the effect has been produced, together with proper certificates of its practicability and adoption, to be delivered to the Society on or before the second Tuesday in March, 1823.

Preventing Explosions in Steam-engine and other closed Boilers.

254. To the person who shall invent and discover to the Society a method of rendering closed boilers used for Steam-engines and other purposes, safer than any now in use, and less liable to accidents from explosion;—*the Gold Medal, and not less than Thirty Guineas.*

Ample certificates that the method has been found to answer its intended purpose, to be produced to the Society on or before the last Tuesday in February, 1823.

An Original Screw.

255. To the person who shall invent and make known to the Society any mode of producing an Original Screw more perfect than any hitherto known;—*the Gold Medal,* or *Thirty Guineas.*

A model, or complete drawing and description of the method, with a screw not less than twelve inches in length, to be produced to the Society on or before the last Tuesday in February, 1823.

Working Drawings of a Steam-engine.

256. To the person who shall produce to the Society the best Working Drawings in plan, elevation, and section, of a condensing Steam-engine in its most improved state, with a full detail of its several parts, and an accurate description thereof;—*the Gold Vulcan Medal,* or *Thirty Guineas.*

The drawings and description to be produced to the Society on or before the first Tuesday in April, 1823, and if rewarded, to remain the property of the Society.

PREMIUMS OFFERED FOR THE ADVANTAGE OF THE COMMERCE OF THE UNITED EMPIRE, AND THE BRITISH COLONIES.

Taking Porpoises.

257. To the people in any boat or vessel, who, in the year 1822, shall take the greatest number of Porpoises, not fewer than thirty, on the coast of Great Britain or Ireland, for the purpose of extracting oil from them;—*the Gold Medal,* or *Thirty Guineas.*

Certificates of the number, signed by the persons to whom they have been sold or delivered for the purpose of extracting the oil, to be produced to the Society on or before the last Tuesday in February, 1823.

Oil from Porpoises, or Sun Fish.

258. To the person who shall manufacture the greatest quantity of Oil from Porpoises or Sun-fish taken on the coast of Great Britain or Ireland, in the year 1822, not less than twenty tons;—*the Gold Medal,* or *Thirty Guineas.*

Certificates of the oil having been made from porpoises or sun-fish actually caught on the coast of Great Britain or Ireland, and two gallons of the oil as a sample, to be produced to the Society on or before the last Tuesday in February, 1823.

Exporting British-cured Herrings.

259. To the person who shall import into the Hamburgh or other continental market previous to February, 1823, the greatest quantity of white herrings cured in British or Irish vessels, not less than 500 barrels, in quality at least equal to the best Dutch herrings, and which in the Hamburgh or other continental market shall produce prices at least equal to the best Dutch;—*the Gold Medal,* or *Fifty Guineas.*

260. For the next greatest quantity, not less than 300 barrels;—*the Gold Isis Medal,* or *Thirty Guineas.*

Proper certificates, and a sixteen gallon cask of the herrings, to be produced to the Society on or before the last Tuesday in February, 1823.

The same premiums to be continued one year longer on similar conditions.

In the 37th and 38th volumes of the "Transactions," will be found valuable communications from Mr. Denovan of Leith, on the cure of British herrings, to which the Society particularly wish to direct the attention of such persons as intend to claim this premium.

Curing Mackarel.

261. To the person who shall, before January, 1822, cure the greatest quantity of Mackarel, not less in number than ten thousand, in the best manner and to the satisfaction of the Society, the same being caught in the British or Irish seas, and cured in a British or Irish vessel or port;—*the Gold Isis Medal*, or *Twenty-five Guineas.*

262. For the next greatest quantity, not less than five thousand;—*the Silver Medal*, or *Fifteen Guineas.*

A sixteen gallon barrel of the mackarel to be produced to the Society on or before the first Tuesday in January, 1823, with certificates that the conditions of the premium have been fulfilled, and that the whole were cured in the same manner as the specimens, together with a full description of the process employed.

The same premiums to be extended one year farther, on similar conditions.

N. B. Specimens of cured mackarel, which promise to afford a most valuable article of trade and food, even superior to herrings, have been sent to the Society, and have induced them to turn the attention of the public thereto, by offering the above premiums.

Nutmegs.

263. To the person who shall grow the greatest quantity of Merchantable Nutmegs, not less than twenty pounds weight, in any part of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or of the several islands adjacent thereto, and equal to those imported from the islands of the East Indies;—*the Gold Medal*, or *Fifty Guineas,*

Satisfactory certificates, from the governor or commander-in-chief, of the place of growth, with an account of the number of trees, their age, nearly the quantity of fruit on each tree, and the manner of culture, together with samples, to be produced on or before the first Tuesday in January, 1824.

The same premium is offered for the year 1825.

Kali for Barilla.

264. To the person who shall have cultivated, in the Bahama islands, or any other part of his majesty's dominions in the West Indies, or any of the British settlements on the coast of Africa, or the several islands adjacent thereto, in the year 1822, the greatest quantity of land, not less than two acres, with a Kali equal to the Spanish Kali for the purpose of making Barilla;—*the Gold Medal*, or *Thirty Guineas.*

265. For the next greatest quantity, not less than one acre;—*the Silver Medal*, or *Fifteen Guineas.*

Certificates signed by the governor or commander-in-chief for the time being, of the quantity of land so cultivated, and of the state of the plants at the time of signing such certificates, to be delivered to the Society, with samples of the kali, on or before the second Tuesday in February, 1823.

The same premiums, on similar conditions, will be given for Barilla grown in 1823.

Destroying the Insect commonly called the Borer.

266. To the person who shall communicate to the Society an effectual method of destroying the insect commonly called the Borer, which is so destructive to the sugar canes in the West India islands;—*the Gold Medal*, or *Fifty Guineas.*

The discovery to be ascertained by satisfactory certificates, under the hand and seal of the governor or commander-in-chief for the time being, and of some other respectable persons, inhabitants of the islands, or other place, in which the remedy has been successfully applied; such certificates to be delivered to the Society on or before the first Tuesday in February, 1823.

Cultivation of Hemp in Upper Canada.

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267. To the person who shall sow with Hemp the greatest quantity of land in

the province of Upper Canada, not less than six arpents (each four-fifths of a statute acre), in the year 1822, and shall at the proper season cause to be plucked the summer hemp (or male hemp bearing no seed), and continue the winter hemp (or female hemp bearing seed) on the ground until the seed is ripe;—*the Gold Medal*, or *One Hundred Dollars*.

268. To the person who shall sow with Hemp the next greatest quantity of land in the same province of Upper Canada, not less than five arpents, in the year 1822, in the manner above-mentioned;—*the Silver Medal*, or *Fifty Dollars*.

Certificates of the number of arpents, the method of culture, of the plucking of the hemp, with a general account whether sown broad-cast or in drills, and of the expense, soil, cultivation and produce, to be transmitted to the Society, certified under the hand and seal of the governor or lieutenant-governor, together with 28 lbs. of the hemp, and two quarts of the seed, on or before the last Tuesday in April, 1823.

Cultivation of Hemp in Lower Canada.

269—270. Premiums exactly similar in all respects to those held out for the province of Upper Canada, are also offered for the province of Lower Canada.

Cultivation of Hemp in Nova Scotia and New Brunswick.

271—272.—Similar premiums in all respects are also offered to the provinces of Nova Scotia and New Brunswick.

Importation of Hemp from Canada, Nova Scotia, and New Brunswick.

273. To the person who shall import to this country the greatest quantity of Marketable Hemp, not less than one hundred tons, in the year 1822, the produce of Canada, or of one of the above-mentioned provinces;—*the Gold Medal.*

274. To the person who shall import the next greatest quantity, not less than fifty tons;—*the Silver Medal.*

Certificates, satisfactory to the Society, to be produced by the master of the vessel on or before the last Tuesday in April, 1823, to testify that such hemp was grown and prepared in Canada, Nova Scotia, or New Brunswick.

Substitute for Hemp.

275. To the person who, in the years 1822 or 1823, shall raise in any of the British colonies, and import, a substitute for Hemp, not less than two tons, equally cheap, durable, and applicable to all the purposes for which hemp is now used;—*the Gold Medal*, or *Fifty Guineas.*

A quantity of the substitute, not less than 20 lbs., together with the proper certificates from the governor, commander-in-chief, or secretary of the colony in which the same has been raised, to be produced to the Society on or before the last Tuesday in February, 1823.

N. B. The premiums from No. 222 to 231, are all extended one year farther, on similar conditions.

Silk.

276. To the person who in the years 1822, 3 or 4, shall raise in any British colony, and import, the greatest quantity of silk proper for manufactures, not less than one hundred pounds weight, from silk worms bred there;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the Silk, not less than one pound, with an account of the method in which the Silk-worms were managed; the kind of the mulberry-trees from whence they were furnished with food, and particulars respecting the culture of the mulberry trees for that purpose, to be produced to the Society on or before the first Tuesday in March, 1823, 4, & 5.

277. For the next greatest quantity, not less than fifty pounds, on similar conditions;—*the Silver Medal*, or *Twenty Guineas.*

Satisfactory certificates from the governor or commander in chief of the district where the said Silk was produced, and of the several particulars above-mentioned, to be delivered to the Society along with the samples required.

Cocoa-Nut Oil.

278. To the person who shall, in the year 1823, import the largest quantity of Cocoa-nut oil, not less than fifty tons, and of the best quality;—*the Gold Medal*, or *Thirty Guineas.*

Proper certificates, with the bills of lading, and samples of the oil, to be produced to the Society on or before the last Tuesday in February, 1824.

This premium is proposed, particularly with a view to encourage the use of Cocoa-nut oil, in the making of gas for the purpose of illumination, such gas having been found much superior to the gases commonly in use.

Olive Oil.

279. To the person who shall, in the years 1824, 5 and 6, manufacture and import the finest specimen of oil, not less than ten gallons, the produce of Olives grown in any British colony, in Africa or New South Wales;—*the Gold Medal.*

280. For the next greatest quantity, not less than six gallons;—*the Silver Medal.*

Specimens of the oil, not less than two quarts, together with satisfactory certificates, to be produced to the Society on or before the last Tuesday in February, 1825, 6 or 7.

Wine from the Cape of Good Hope.

281. To the person who shall import, in the years 1823 or 1824, the finest Wine, not less than twenty gallons, made from the produce of Vineyards at the Cape of Good Hope, or the parts adjacent;—*the Gold Medal.*

The above premium is not offered for the sweet or Constantia wine, the quality and value of which are sufficiently known, but to encourage the improvement of the vineyards more recently established.

Samples of the wine in bottles, bills of lading, and certificates of the governor or secretary of the colony, that the wine was made in the colony, to be produced to the Society on or before the first of March, 1823 or 1824.

Wine from New South Wales.

282. To the person who shall import in the years 1824 or 1825, the finest Wine, not less than twenty gallons, of good marketable quality, made from the produce of Vineyards in New South Wales;—*the Gold Medal.*

Samples of the wine in bottles, bills of lading, and certificates of the governor or secretary of the colony, that the wine was made in the colony, to be produced to the Society on or before the first of March, 1824 or 1825.

Wool from New South Wales.

283. To the person who, previous to February 1824, shall import into Great Britain or Ireland, the greatest quantity, not less than two tons, of fine wool, the produce of New South Wales;—*the Gold Medal.*

Proper certificates, with the bills of lading, and samples of the wool, to be produced to the Society on or before the last Tuesday in February, 1824.

284. For the next greatest quantity, not less than one ton, on similar conditions;—*the Silver Medal.*

Fine Wool from New South Wales.

285. To the person who shall produce to the Society the finest sample of wool, the produce of New South Wales, equal to the best Saxon;—*the Gold Medal.*

Not less than 14 lbs. of the wool to be produced to the Society on or before the last Tuesday in February, 1824, together with certificates, that at least 5 cwt. equal to the sample has been imported by the claimant.

Importing the Cashmere Shawl Goat.

286. To the person who shall have imported into the United Kingdom, subsequent to the first of January, 1822, the greatest number, not fewer than three females and two males, of the real Cashmere Shawl Goat;—*the Gold Medal.*

Certificates that the goats are of the real Cashmere breed, and that they are in health at the time of making the communication, to be produced to the Society on or before the first Tuesday in March, 1823.

This premium is offered also for the years 1824 and 1825.

China Paper for Copper-Plate Printing.

287. To the person who shall communicate to the Society the best account of the process employed in China for the manufacture of paper used in England for Copper-Plate Printing, and known by

the name of India Paper, together with an account of the materials from which such paper is made;—*the Gold Medal*, or *Fifty Guineas.*

Specimens of the paper, not less than one ream, with samples of the materials in their raw or unmanufactured state, and satisfactory certificates, to be produced to the Society on or before the first Tuesday in March, 1824, or 1825.

Annatto.

288. To the person who, in the year 1822, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of Annatto, equal to that imported from Spanish America, not less than one hundred weight;—*the Gold Medal.*

A quantity of the annatto, not less than ten pounds weight, to be produced to the Society, with proper certificates, signed by the Secretary of the Board of Trade of the respective Settlement, that the annatto is the produce of such settlement, on or before the last Tuesday in February, 1823.

True Cochineal.

289. To the person who, in the year 1822, shall import into the port of London, from any part of the British settlements in the East Indies, the greatest quantity of true Cochineal, equal to that imported from Spanish America, not less than one hundred weight;—*the Gold Medal.*

A quantity of the Cochineal, not less than three pounds weight, with proper certificates, signed by the Secretary of the Board of Trade of the respective settlement, that the Cochineal is the produce of such settlement, to be produced to the Society on or before the first Tuesday in February, 1823.

N. B. The premiums from No. 243 to 245 inclusive, are all extended two years farther on similar conditions.

China Tea.

290. To the person who shall communicate to the Society, from information obtained in China, the best and most authentic account of the culture of the plant or plants, the leaves of which furnish the different kinds of tea; together with the method of gathering, drying, and otherwise preparing the leaves;—*the Gold Medal.*

The communication, with the necessary certificates, to be sent in to the Society on or before the last Tuesday in March, 1824.

This premium is extended to the years, 1825 and 1826.

Extirpating the Stumps and Roots of Trees.

291. To the person who shall invent and discover to the Society, the best method, verified by actual experience, of raising out of the earth and removing the stumps and roots of trees which have been left after felling the timber, so as to clear the land for the purposes of cultivation;—*the Gold Medal*, or *Fifty Guineas.*

Certificates that the method has succeeded with at least fifty trees of large girth, and a full description of the means employed, to be delivered to the Society on or before the last Tuesday in February, 1823.

BRITISH MARBLES.

THE SOCIETY considering that it would be beneficial to the Commerce of the United Kingdom to bring the British Marbles into general use, and that the most effectual method of accomplishing their object would be, for the present, *to make them more generally known in the Capital, have come to the following Resolution:—*

Resolved, That specimens of British Marbles be exposed in the Society's Rooms, in the Adelphi, for the inspection of the public under the following regulations:

1st, That all the specimens be exact to a given size, viz. eight inches high, six inches broad, one thick, and polished on one face.

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2nd, That a book be kept, containing the number of each specimen, and describing the situation of the quarry, the name and situation of the parish, the distance of the quarry from a beaten road, and the distance of that road from water-carriage, with the name of the donor and proprietor. Any remarks on the qualities of the Marbles, or on the lime produced from them, will be gratefully received and preserved by the Society, as materials for future inquiries.

As the exertions of the Society can be generally beneficial only inasmuch as their views are seconded by the public, the Society request, that all proprietors of Marble Quarries will favour them with a specimen of the Marble, worked to the exact size above-mentioned, with the description of the quarry as above, that the same may be entered in the book to be preserved for the use of the public. By such arrangements, it is expected, that the interest of the proprietors of the quarries will be promoted, and the use of British Marble much extended. A variety are already exhibited in the Society's Rooms.

REWARDS BESTOWED BY THE SOCIETY DURING THEIR SESSION WHICH COMMENCED ON THE FIRST WEDNESDAY IN NOVEMBER, 1821, AND CLOSED ON THE SECOND WEDNESDAY IN JUNE, 1822.

IN AGRICULTURE AND RURAL ECONOMY.

1. To Messrs. Cowley and Staines, Winslow, Bucks, for drawing turnips in the month of November 1821, and preserving the same in a sound state, fit for feeding Cattle, to the end of April, 1822, *the large Gold Medal.*
2. To the same, for cultivating 4 acres of the White Poppy (papaver somniferum) and extracting from it 60 lbs. of solid opium, equal to the best Turkey opium, *Thirty Guineas.*
3. To J. Peart, Esq. Settle, Yorkshire, for reclaiming 56 acres of waste moor land, *the large Gold Medal.*
4. To Mr. A. Biddle, Playford, near Ipswich, for a hay borer, *the large Silver Medal.*

IN POLITE ARTS.

1.—Original Oil Paintings.

1. To Mr. S. Platt, 33, Keppel Street, for an original oil painting of fruit, *the Gold Isis Medal.*
2. To Mr. R. Turner, 46, High Street, Wapping, for an original portrait in oil, *the Silver Isis Medal.*
3. To Miss Eliza Anne Drummond, 14, Church Street, Soho, for an original portrait in oil, *the Gold Isis Medal.*
4. To Mr. E. Fancourt, 31, Hoxton Square, for an original portrait in oil, *the large Silver Medal.*
5. To Mr. Fred. W. Watts, High Street, Hampstead, for an original landscape from nature, in oil, *the Silver Isis Medal.*
6. To Miss Joanna Smith, 22, Carmarthen Street, for an original landscape in oil, *the large Silver Medal.*
7. To Miss S. Matilda Arnald, 2, Weston Street, Pentonville, for an original painting of flowers in oil, *the large Silver Medal.*

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8. To Mr. T. Gwennap, 9, Amelia Place, Brompton, for an original painting of fruit in oil, *the Gold Isis Medal.*
9. To Mr. H. B. Zeigler, 40, Brewer Street, Golden Square, for an original landscape in oil, *the large Gold Medal.*
10. To Mr. Fred. W. Watts, High Street, Hampstead, for an original landscape composition in oil, *the Gold Isis Medal.*
11. To Miss Caroline Hanning Evatt, East Hill, Wandsworth, for an original portrait in oil, *the Silver Isis Medal.*
12. To Mr. H. W. Watts, 3, Bury Street, Bloomsbury, for an original composition of figures in oil, *the Silver Isis Medal.*

2.—Copies in Oil.

13. To Mr. Ed. Knight, Covent Garden Chambers, for a landscape in oil, a copy, *the large Silver Medal.*
14. To Miss Emma Davies, 14, Surrey Square, for a copy in oil of an historical figure, *the large Silver Medal.*
15. To Mr. J. Knight, Covent Garden Chambers, for a copy in oil of an historical figure, *the large Silver Medal.*
16. To Mr. S. Drummond, 14, Church Street, Soho, for a copy in oil of an historical picture, *the Silver Isis Medal.*
17. To Mr. Philip Corbett, 482, Strand, for a copy in oil of an historical figure, *the Silver Isis Medal.*
18. To Mr. J. Bridges, 43, Wardour Street, Soho, for a copy in oil of a portrait, *the large Silver Medal, with a Gold Rim.*
19. To Mr. Philip Simpson, 10, Carlisle Street, Soho, for a copy in oil of a portrait, *the Silver Isis Medal, with a Gold Rim.*

3.—Original Paintings in Water Colours.

20. To Mr. M. H. Holmes, 8, Norfolk Street, Strand, for an original composition in water colours of still life, *the Silver Palette.*
21. To Miss S. Hefer, Carlisle Place, Lambeth, for an original painting of flowers in water colours, *the Silver Palette.*
22. To Miss S. Eliz. Bowley, 7, Sebbon's Buildings, Islington, for an original painting of flowers in Water Colours, *the Silver Isis Medal.*
23. To Miss M. Heape, Coventry, for an original composition of figures in water colours, *the large Silver Medal.*
24. To Miss Louisa A. Shaw, Plymouth, for an original painting of flowers in water colours, *the large Silver Medal.*
25. To Mr. R. Hudson, 85, Cheapside, for an original historical composition in water colours, *the large Silver Medal.*

4.—Copies in Water Colours.

26. Mr. J. H. Farrer, 27, Euston Street, Euston Square, for a copy of a print in water colours, *the Silver Isis Medal.*

5.—Original Drawings in Ink, Pencil, Chalk, &c.

27. To Mr. J. F. Taylor, 17, Baker Street, Portman Square, for an original pencil drawing of a landscape, *the Silver Palette.*
28. To Mr. George Nicholson, Liverpool, for an original drawing in pen and ink of a landscape, *the Silver Isis Medal.*

6.—Copies in Ink, Pencil, Chalk, &c.

29. To. Mr. J. Flaxman Denman, 39, Newgate Street, for a copy in Indian ink of figures, *the Silver Palette.*
30. To Mr. R. H. Horne, St. James's Place, Hampstead Road, for a copy in Indian ink of a print, *the Silver Palette.*

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31. To Miss Jane Simpson, 8, Harpur Street, for a copy in chalk of a head, *the Silver Palette.*
32. To Miss Palin, 76, Holborn Bridge, for a copy in chalk of a head, *the Silver Palette.*
33. To Miss Anne Smith, Judd Place, West, for a copy in chalk of a head, *the Silver Palette.*
34. To Miss Sarah Sophia Seabrook, 78, Hatton Garden, for a copy in chalk of a head, *the Silver Palette.*
35. To Miss Eliz. H. Peacocke, Putney House, Putney, for a copy in chalk of a Holy Family, *the Silver Isis Medal.*
36. To Miss Richardson, Piazza, Covent Garden, for a copy in chalk of a figure, *the Silver Palette.*
37. To Miss Elizabeth Clarke, 6, Cadogan Terrace, Sloane Street, for a copy in chalk of a Madonna and Child, *the Silver Isis Medal.*
38. To Miss Mary Birch, Warwick, for a copy in Indian ink of figures, *the Silver Palette.*
39. To Mr. T. D. White, 14, Brownlow street, Holborn, for a copy in chalk of a head, *the Silver Palette.*
40. To. Mr. Jos. Phelps, 27, St. Martin's Lane, Cannon Street, for a copy in pen and ink of a head, *the Silver Isis Medal.*
41. To Miss Jane Turner, Warren Street, Fitzroy Square, for a copy in pencil of a landscape, *the Silver Palette.*

7.—Copies in Outline.

42. To Mr. E. Williams, Ambroseden, near Bicester, for an outline drawing of a figure, *the Silver Palette.*
43. To Mr. T. Fairland, 4, Princes Street, Commercial Road, Lambeth, for an outline drawing of a figure, *the Silver Isis Medal.*

8.—Miniatures.

44. To Miss Smith, 16, Weston Street, Somers Town, for an original miniature, *the Silver Isis Medal.*
45. To the same, for a copy of a miniature, *the large Silver Medal.*

9.—Drawings from Statues and Busts.

46. Mr. W. Gill, 12, Devereux Court, Strand, for a drawing in chalk from a bust, *the Silver Isis Medal.*
47. To Mr. J. Padgett, 2, Bury Street, St. James's, for a drawing in chalk from a bust, *the Silver Palette.*
48. To Mr. L. Macartan, 18, Hill Street, Berkeley Square, for a drawing in chalk of the Farnese Hercules, *the Silver Isis Medal.*
49. To Mr. G. Presbury, 41, John Street, Fitzroy Square, for a drawing in chalk of the Boxers, *the large Silver Medal.*
50. To Mr. James Middleton, Manor Place, Walworth, for an anatomical drawing from a cast, *the large Silver Medal.*
51. To Mr. W. Fairland, 4, Princes Street, Commercial Road, Lambeth, for an anatomical drawing from a cast, *the Silver Isis Medal.*
52. To Mr. T. Fairland, 4, Princes Street, Commercial Road, Lambeth, for a drawing in chalk of a horse's head, from the Elgin marbles, *the Silver Isis Medal.*
53. To Mr. F. Howard, 5, Newman Street, for a drawing in chalk of a horse's head, from the Elgin Marbles, *the Silver Palette.*

10.—Models in Plaster.

54. To Mr. J. Preece, 6, Upper Mary-le-bone Street, for a copy of a group, *the Silver Isis Medal.*
55. To Mr. W. Theed, 75, Dean Street, Soho, for a copy of a single figure, *the Silver Isis Medal.*
56. To Mr. Jas. Legrew, 7, Palace Street, Pimlico, for a copy of a single figure, *the Silver Palette.*

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57. To Mr. T. Smith, 57, Upper Norton Street, for an original group of two figures, Œdipus and Antigone, *the large Silver Medal.*

58. To Mr. J. Wood, 3, High Street, Whitechapel, for an original group of three figures, Adam and Eve lamenting over the body of Abel, *the Gold Isis Medal.*

59. To Mr. C. Smith, 57, Norton Street, Fitzroy Square, for an original group of more than three figures, the Fight for the Body of Patroclus, *the large Gold Medal.*

11.—Architectural.

60. To Mr. Jas. B. Bunning, 11, Bernard Street, for a drawing of Bow Church from actual measurement, *the Silver Isis Medal.*

61. To Mr. C. Purser, 10, Lawrence Pountney Lane, for a drawing of St. Martin's Church, from actual measurement, *the large Silver Medal.*

62. To Mr. T. Plowman, Oxford, for an original design in Gothic architecture, *the large Silver Medal.*

63. To. Mr. C. Papendiek, Kew Green, for an original design for a Court of Justice, *the large Silver Medal.*

64. To Mr. E. Taylor, 5, Salisbury Street, Strand, for an original design for a Court of Justice, *the Gold Isis Medal.*

12.—Engravings.

65. To Miss M. Radclyffe, Birmingham, for an etching of a landscape, *the Silver Palette.*

66. To Mr. T. F. Ranson, 31, Judd Place, West, for a finished historical engraving, *the Gold Isis Medal.*

67. To Mr. T. Lupton, 7, Leigh Street, Burton Crescent, for a portrait in mezzotinto on soft steel, *the Gold Isis Medal.*

13.—Needlework.

68. To Mrs. Nicholson, Liverpool, for a copy of an historical picture, *the Gold Isis Medal.*

14.—Medal Dies.

69. To Mr. B. Faulkener, Birmingham, for a medal die, a portrait, *the large Silver Medal.*

IN MANUFACTURES.

1. To Mr. E. Richards, Bethnal Green, for an improvement in the silk weavers' draw-boy, *Twenty Guineas.*

2. To Mr. J. Hughes, Patience Street, Bethnal Green, for an improvement in the silk weavers' draw-boy, *Five Guineas.*

3. To Mr. J. Thompson, Jun. Coventry, for an improvement in the silk ribbon loom, *the Gold Vulcan Medal and Fifty Guineas.*

4. To Mr. Stephen Marshall, Merton Bridge, Surrey, for improved blocks for calico printers, *Fifteen Guineas.*

5. To Mr. J. Parry, Little Mitchell Street, Bartholomew Square, for the manufacture of plat from Leghorn straw, *the large Silver Medal.*

6. To Mrs. Wells, Connecticut, United States, for a new material for fine plat in imitation of Leghorn, *the large Silver Medal and Twenty Guineas.*

7. To Mr. T. Starkey, Huddersfield, for fine broad cloth made entirely of wool from New South Wales, *the Gold Isis Medal.*

IN CHEMISTRY AND MINERALOGY.

1. To Mr. H. W. Reveley, 33, King Street, W. Bryanstone Square, for his communication respecting the nature and preparation of the stones used in Tuscany, for grinding fine flour, *the large Silver Medal.*

2. To J. Meigh, Esq. Shelton, Staffordshire, for the discovery of a glaze for vessels of common red earthenware, not prejudicial to the health of those who make use of them, *the large Gold Medal.*

IN MECHANICS.

1. To Mr. G. Holditch, Lynn Regis, for a life-beacon, *the large Silver Medal and Ten Guineas.*
2. To Mr. J. Millikin, 301, Strand, for an improved bistoury, *the large Silver Medal.*
3. To Lieut. R. P. Littlewort, R. N. for an improved ship's compass, *the large Silver Medal.*
4. To Mr. J. Watson, Western Exchange, for a system of musical notation, for the use of the blind, *the Silver Vulcan Medal.*
5. To Mr. C. Goodwin, London Wall, for an improved bridle bit, *the large Silver Medal.*
6. To Mr. R. Thom, Rothesay Mills, near Glasgow, for a hydraulic apparatus for regulating the supply of water to mills, *the large Silver Medal.*
7. To H. Gordon, Esq. Capt. R. N. 6, Ranelagh Street, Pimlico, for a life boat, *the Silver Vulcan Medal.*
8. To Mr. R. Pering, Clerk of the Cheque, Royal Dock Yard, Plymouth, for a wrought iron carriage for ships' guns, *the Silver Vulcan Medal.*
9. To Mr. C. A. Busby, Strand, for a hydraulic orrery, *the Gold Vulcan Medal.*
10. To Mr. A. Ainger, Everett Street, for a general correctional scale for temperature for hydrometers, *the Gold Vulcan Medal.*
11. To Mr. W. Wynn, Dean Street, Soho, for an improved hammer for turret-clocks, *Twenty Guineas.*
12. To Mr. Ez. Baker, Whitechapel Road, for an improved mainspring for fire arms, *the Silver Vulcan Medal.*
13. To Mr. W. Hookey, Master Shipwright's Assistant, Royal Dock Yard, Woolwich, for a coffer for repairing ships afloat, *the large Silver Medal.*
14. To Mr. Hall, Glasgow, for a self-acting apparatus for supplying steam boilers with water, *Ten Guineas.*
15. To Mr. Abraham, Sheffield, for a magnetic guard for persons employed in dry grinding, *the large Gold Medal.*
16. To Mr. Eustace Wigzell, 10, New Millman Street, for an instrument for marking a ship's place on a chart, *the large Silver Medal.*
17. To Mr. S. Bowler, 34, Uxbridge Street, Newington Causeway, for a rat-trap, *Five Guineas.*
18. To Mr. W. Bailey, 272, High Holborn, for an improved method of opening and shutting the windows of churches and other public buildings, *the Silver Vulcan Medal.*
19. To Mr. G. Savage, St. James's Street, Clerkenwell, for a detached escapement, *the large Silver Medal.*

IN COLONIES AND TRADE.

1. To J. M'Arthur, Esq. New South Wales, for importing 15,130 lbs. of fine wool, the produce of his own flock in New South Wales, *the large Gold Medal.*
2. To the same, for importing certain quantities of wool, equal to the fine electoral Saxon wool, the produce of his own flock in New South Wales, *the large Gold Medal.*
3. To J. Raine, Esq. for opening a market for the wool raised in the Settlement of Van Diemen's Land, and for his exertions in improving the quality of the same, *the Silver Ceres Medal.*
4. To the same, for importing 400 tuns of sea-elephant oil, procured within the limits of the colony of New South Wales, *the large Silver Medal.*

*** Since the last Distribution, Two Hundred and Seven new Members have been elected.

By Order, ARTHUR AIKIN, *Sec.*

PAPERS

IN

AGRICULTURE

AND

RURAL ECONOMY.

N° I.

RECLAIMING WASTE MOOR LAND.

The LARGE GOLD MEDAL, *the premium offered, was this Session presented to* J. PEART, *Esq., of* SETTLE, *for* RECLAIMING FIFTY-SIX ACRES OF WASTE MOOR-LAND. *The following communications have been received from the Candidate on the subject.*

SIR; Settle, Nov. 30th, 1820.

I TAKE the liberty of requesting you will lay before the Society of Arts, Manufactures and Commerce, the following account of the improvement of fifty-six acres, three roods, and twenty-five perches of land, statute measure, lying waste and uncultivated, and the expenses attend-

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ing such improvement, and for which I beg to offer my claim for their Gold Medal.

Having many complaints by labourers in husbandry, of the want of work, I was induced to give employment to those who applied for it, by cultivating two parcels of waste ground, the one being at Grassington, called New Pasture Allotment, and containing forty acres and two roods, and the other near Ingleton, called Bastongill, containing sixteen acres, one rood, and twenty-five perches.

The land at Ingleton was of the worst quality I have ever yet seen attempted to be cultivated, being a short ling, on a black, barren, turbary soil; that at Grassington was covered with a strong ling on turf earth, with yellow soil under the turf. The situation of this land being too high for crops of corn, I have endeavoured to convert it into grass land, and in a way different from any which I have yet seen tried, and though the plan I have adopted has been very expensive, I am inclined to think it will answer better, by the increased expense, than any I have seen practised. The usual way of improving this sort of land for grass (where its situation is too high for crops of corn) has been, either by ploughing, or by paring and burning, or paring only, and then (after draining such parts as required it), sowing it with grass seeds, and liming it on the surface. The objections to this practice are, that the old sward has not been completely destroyed, but has grown in the seams, and the surface by ploughing not being made level, a great part of the lime has fallen into the seams, and a considerable part of the surface of the land remained uncovered with lime.

The plan I have pursued on the above parcels of land was, first to burn the ling, where it was strong, then

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to grave the land with spades; after that was done, I caused the whole surface to be made perfectly level, by cutting it with sharp spades, then had it limed, and sown with grass seeds, grown in the neighbourhood, and white Dutch clover seed; part of the land was sown with seeds before the lime was spread, and the remainder was sown after the lime was spread on the surface. The advantage of graving was, getting the ground turned up deeper than if it had been ploughed, and bringing up a little yellow soil, which generally lies underneath the turf, and which tends to make the land firmer, and more congenial to the growth of grass seeds than turf soil, and also getting a much more level surface. As I attach much importance to the land being made very level on the surface, previous to the grass-seeds being sown, I was induced to have the whole of this land levelled by persons at days wages, as I hardly knew what it deserved by piece work; and if I had let it by the acre, I feared it might not have been done to my satisfaction. I have laid a much greater quantity of lime, and sown a greater quantity of grass-seeds on this land, than I ever before saw practised; and though the expense has been very great, I have no doubt, from the present appearance of the land, the seeds being in a flourishing state, but it will answer a profitable purpose, my opinion being, that the land will in two years fatten any sort of cattle, and be worth to rent from twenty-five shillings, to thirty shillings an acre, and in its unimproved state, it was not, on an average, worth more than three shillings an acre. The land is in my own possession, and it is my intention to buy cattle upon it, and sell them from it, in order to ascertain what profit it will make, and thereby know the advantage resulting from this experiment.

On the land at Grassington, there were a great many lead-

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mine hillocks, which I caused to be led away, and spread on the blackest earth, which will tend to make the turbary land more firm and stiff.

There are millions of acres of this sort of land in the kingdom, and therefore, it appears to me of importance to find out the best method of bringing this sort of land into grass land, in situations where it is too high for corn; for the most valuable grasses grow well in the highest climates, and in pasturing land, it is not of much importance that there are any buildings on the land, or that it is near a town or village.

In the annexed paper, marked No. 1, is a particular of the expenses of improving the land at Grassington, which contains 40 acres, 2 roods, and a Certificate, signed by Mr. Bentham, the curate of the parish of Linton, in which parish Grassington is situate, of his belief, that the statement is correct; and there is also the Certificate of Emanuel Lawson, who constantly superintended, on my behalf, the improvements on that parcel of land; and in the annexed paper marked, No. 2, is a particular of the expenses of improving the land at Ingleton, containing 16 acres, 1 rood, and 25 perches, and a Certificate, signed by Mr. Waller, the incumbent curate of Ingleton, of his belief, that this statement is correct, and I also hereby certify, that both those statements are accurate and correct,

I am, Sir,

A. Aikin, Esq.,
Sec. &c. &c.

&c. &c. &c.,

JOHN PEART.

No. 1.—AN Account of money paid by John Peart of Settle, in the county of York, between the first of November, 1819, and the 12th November, 1820, for improving a

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parcel, of land lying waste and uncultivated, being peat earth, and covered chiefly with strong ling; called New Pasture Allotment, containing 40 acres, 2 roods, statute measure, and situate at Grassington, in the parish of Linton, in the county of York.

	£.	s.	d.
Paid to sundry persons, for graving with spades 40 acres, 2 roods, of land, at from 2 guineas to 2*l.* 5*s.* per acre	93	3	0
Paid to sundry persons, for days works for levelling the land with sharp spades, after it was graven, at from 2*s.* to 3*s.* per day . .	66	13	1
Paid for building a lime-kiln on the land . .	8	0	0
Paid for 1,504 bushels of hay-seeds grown in the neighbourhood, sown on the graven land, at from 9*d.* to 11*d.* per bushel	61	6	7
Paid for 236 pounds of white Dutch clover seed, sown on do.	12	2	0
Paid Joseph Tomlinson, for cutting, walling, and filling 578 rods of stone drains, at 13*d.* per rod, of seven yards	31	6	2
Paid do. for cutting, walling, and filling, 300 rods of do. at 15*d.* per rod	18	15	0
Paid William Lambert for 7,899 loads of lime (each load being three bushels), laid on the graven land, at 7½*d.* per load	246	6	10
Paid for leading the lime from the kiln . .	31	4	11
Paid for spreading the lime on the land . .	8	17	0
£.	574	11	7

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CERTIFICATES.

I, the Rev. John Bentham, curate of the parish church of Linton, in which parish the above-mentioned land is situate, do hereby certify, that I know the above-named John Peart, and believe the above account to be true. Witness my hand, this 22nd day of November, 1820.

JOHN BENTHAM.

I, Emanuel Lawson, of Threshfield, in the parish of Linton, who superintended on the part of the said John Peart, the improvements above-mentioned, do hereby certify, that the above account is true. Witness my hand, this 22nd day of November, 1820.

EMANUEL LAWSON.

No. 2.—AN account of money paid by John Peart, of Settle, in the county of York, banker, between the 1st of November, 1819, and the 12th November, 1820, for improving a parcel of land lying waste and uncultivated, being peat earth, and covered, previous to its improvement, chiefly with short ling, called Bastongill, containing 16 acres, 1 rood, 25 perches, statute measure, and situate within the township of Ingleton, in the county of York.

	£.	s.	d.
Paid Foster & Co., for graving with spades, 16 acres, 1 rood, 25 perches, at 3*l.* 6*s.* per acre	54	4	9
Paid for days work for levelling the land			

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	£.	s.	d.
with sharp spades after it was graven, at from 2*s.* to 2*s.* 6*d.* per day	23	8	3
Paid Spedding & Co., for cutting, walling, and filling, 310 rods of stone drains, at 14*d.* per rod, of 7 yards	18	1	8
Paid for 1,160 bushels of hay seeds, grown in the neighbourhood and sown on the graven land, at from 8*d.* to 10*d.* per bushel . . .	48	4	6
Paid for 140 pounds of white Dutch clover seed, sown on this land	7	4	0
Paid for days work for sowing the above seeds	1	17	6
Paid for leading loose stones from the land .	1	17	0
Paid for 2,410 loads of lime (each load containing 3 bushels), laid on the land at 9½ per load	95	7	11
Paid for spreading the lime, at 2*s.* 6*d.* per hundred load	2	15	3
	£.253	0	10

CERTIFICATE.

I, the Rev. William Waller, curate of the chapel of Ingleton, in which chapelry the above land is situate, do hereby certify, that I know the above-named John Peart, and believe the above account to be true. Witness my hand, this 20th day of November, 1820.

WILLIAM WALLER, B. D., *Incumbent Curate of Ingleton.*

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Extract of a Letter from Mr. Peart.

Settle, November 28th, 1821.

I have now to observe, that the improvements described in my former communication, are fully answering my expectations, the land being now covered with a rich sward, and the sheep which were this year put upon it, were made very fat. I have every reason to believe that the land stated to be improved, will next year fatten 20 Scot heifers, and 50 ewes with their lambs; and I think it the best and greatest improvement I have seen on this sort of land, and much superior to ploughing, which is the plan usually adopted.

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No II.

ENGLISH OPIUM.

The premium of THIRTY GUINEAS *was this Session presented to Messrs.* COWLEY *and* STAINES, *Surgeons, of Winslow, Bucks, for cultivating* FOUR ACRES OF THE WHITE POPPY *(Papaver somniferum), and extracting therefrom,* 60 *lbs. of* SOLID OPIUM, *equal to the best Turkey Opium. The following communication has been received from the Candidates; and specimens of the Opium, of the Poppy-seed, and of the Oil, together with the implements employed in the cultivation of the plants, and extraction of the Opium, have been placed in the Repository of the Society.*

SIR; Winslow, Bucks.

IN consequence of a premium being offered by the Society for Encouraging Arts, Manufactures, and Commerce, for the cultivation of the *papaver somniferum,* for opium, we are induced to communicate an account of our experiments on that plant, for the perusal of the Society.

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Reading of the method employed in the year 1794, by Mr. Ball, of Willison, and perceiving that it had received the approbation of the Society, we became desirous of trying his process, and did so on a small scale, in several seasons; but although we never failed to produce excellent opium, there appeared no prospect of enlarging the scale of our operations with advantage, chiefly on account of the great difficulty and expense, which attended the operation of properly scarifying the poppy head. The discovery of an error in Mr. Ball's calculations, gave us additional discouragement; that gentleman states the produce of an acre to be 50 lb., supposing a square foot to produce one grain, whereas, on that calculation, it would only amounnt to between five and six pounds.

In the year 1819, we contrived the scarificator (Plate 1, fig. 1), and were so much encouraged by the increased facility afforded by its operation, as to undertake 15 poles of poppies. This little piece was selected from six acres of poppies, on account of bearing a very regular crop. It afforded employment to two women, for 9 days, who received 1*s.* per day, which made the expense of collecting, &c., 12*s.* per lb., as they procured one pound and a half of solid opium, of which we inclose a specimen. The cultivation was similar to that pursued in the two following years, we need not therefore particularize it, until we describe our progress in the year 1821. The only peculiarity was, a very fine season throughout.

In 1820 we constructed the scarificator (fig. 2), which was employed on 1 acre, 5 perches, of poppies, and was found much superior to our first contrivance, both in facility of application, and in dispatch. The process was begun, July 19, and finished August 2, producing 21*lb.*, 8*oz.*, 2*dr.*, of opium, in the recent state; which was

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reduced, by evaporation, to 15*lb.*, 5*oz.*, 6*drs.* (avoirdupois) of solid opium, a specimen of which accompanies this communication. The crop was pretty perfect, but the people were hindered by frequent showers. The table, No. 1, will explain their daily progress and expense.

We will now endeavour to describe minutely, the cultivation and process employed last year.

In the beginning of February, 1821, a field measuring 4 acres, 1 rood, 35 perches, exclusive of fences, &c., which had borne two successive crops of poppies, and had received a ploughing immediately after the removal of the last, in the preceding Autumn, was ploughed a second time, and sown with seed of the *papaver somniferum*, between the 10th and 15th; the seed was the growth of the preceding year, and was drilled with 21 inch intervals. It came up by March 14th, and held out the promise of a full crop until the beginning of April, when some remarkably heavy showers of rain occurred, which made the crop extremely imperfect, intervals of from one, to twenty yards appearing all over the field. One acre was patched with potatoes, and the remainder with Swedish turnips; the former did very well, but the latter were destroyed by the fly, excepting a small residue, which was drawn in July, and transplanted, to fill up a crop of Swedes a mile distant; which, though more fortunate than these patches, had yet suffered severely from the same cause.

The intervals between the drills were hoed by the first week in May. This operation was found to require much care, in consequence of the immense number of annuals with which the land was infested. The difficulty was much diminished when the distinctive characters of the *papaver somniferum*, became familiar to the new labourers. These were soon able to distinguish the poppies from all

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the weeds which bore a general resemblance, excepting the *papaver rhœas*, which puzzled them a good while. It should be observed, that the difficulty was owing, in a great measure, to the imperfection of the crop; where that was good, it derived from continuity, a character, by which it was sufficiently distinguished from the surrounding weeds.

This hoeing was best performed by the hoe, figs. 3 and 4. The common hoe was found highly objectionable; it buried the very minute poppies with mould, which the other permitted to pass through; the weeds too, were very small, and more easily destroyed by merely cutting them below their seminal leaves, than by deeper hoeing.

The poppies were next set out with the hoe, figs. 5 and 6; two boys being allowed to each hoer to pull up weeds and supernumerary poppies, to which the hoe could not be applied. The affixed paddle was found of great service in removing weeds from the off side of the row.

A space of 4 inches from plant to plant, was deemed most advantageous, because, although heads as large and as numerous might be obtained by separating the plants to a foot apart, yet their situation would be more perilous, when strong winds happened, because such weather usually, either roots up the plant, or breaks the stem just above the earth, and neither the root nor stem of a poppy loaded with six heads, are supposed to possess double the strength of one bearing three.

The setting out was finished by the latter end of May, after which, no difficulty was experienced in the management of the crop, nor any expense beyond what would have been incurred by keeping a crop of drilled beans equally clean on the same land. The hoeing was afterwards performed at 2*s*. per land; this, with hand weeding,

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amounted to about 5*s.* per acre; it was repeated three, and in some parts four times after the plants were set out.

The poppies having flowered, and generally lost their petals were observed to be covered with a blueish white bloom. We had before decided, that this appearance was the proper criterion of the best time for commencing the process for extracting the opium.

Without waiting until the whole crop was ready, the operation was commenced, July 24th, in the following manner: each person was provided with a scarificator, fig. 2; a knife, fig. 7; and a receiver, fig. 8; a row was then appropriated to each person, who was directed to take a poppy head in the left hand, and twisting it towards the right, to apply the scarificator with the right hand, so as to make the incisions in a horizontal direction, near the top of the head, and to a third part of the extent of its circumference in a sunny aspect.

Twisting the head was found to expedite the operation by dividing the motion between the right hand, and the poppy, by the return of the latter to a natural position. Horizontal wounds were preferred, as tending most to retain the juice until it became coagulated, which in warm weather was effected in about 20 minutes after it had exuded. Still, drops would fall to the ground from some of the heads; to remedy this as much as possible, the incision was made near the top of the head, and the sunny aspect given to the first incision, as the most important to be early secured. The best workers were placed first, as much mischief was found to result from permitting them to pass each other, their clothes wiping the opium from their neighbours' rows.

In this manner they proceeded about two hours, when the opium which had first exuded, was found to have

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acquired consistence enough to admit of being scraped off. About three-fourths of the people were then employed to scrape off the opium with their knives, occasionally transferring it to their receivers, which were tied round the waist. The scarifiers in the meantime pursuing their work, until the approach of evening or apprehension of rain, rendered it desirable to employ the whole party to finish the scraping.

In this manner, the whole piece was treated, when another incision was formed in continuation of the first, and of similar extent, the circle being completed by the third incision; when a second series was commenced just below the first, and conducted in the same manner.

This description applies to the work of the more careful people, for the novelty of the employment was, to some, a source of some little confusion. No inconvenience resulted, provided the whole row was scarified in one aspect, otherwise the scraper was extremely apt to pass many heads unnoticed.

The poppies were found to produce opium freely, until the third or fourth incision, when the quantity was observed to diminish rapidly. Nevertheless, many continued to bleed freely even to the tenth incision, proving that the poppy has the power of secreting this peculiar liquid from its common juices. This opinion is confirmed by the fact of the plant continuing to furnish opium twice as long in a wet, as in a dry season.

The opium was weighed daily, and the process continued until the produce at an estimate of 30*s.* per pound, would no longer replace the expense. For the daily collection, and weekly expense, *vide Table 2.*

The opium which had daily accumulated in a 12 gallon pan, was now found to weigh 97*lb.* 1*oz.* It was well stirred,

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and evaporated in 4 large tin vessels which were placed in the sun, and occasionally moved, so as to keep the bottoms perpendicular to his rays. Two women were constantly employed to stir the surfaces which was necessary to break the film which was constantly formed either by evaporation, or absorption of oxygen from the atmosphere.

When the opium was found to be sufficiently exsiccated, it was formed into balls, as large as cocoa nuts, and then rolled in dried poppy leaves, when the weight of it was 60*lb.* 1*oz.* 4*dr.* a sample of this is inclosed.

The poppies were suffered to stand until the stalk, near the head, began to turn yellow, this was known to indicate a sufficient, though not very complete maturity of the seed. They were pulled with the root, on the 18th of August, and laid flat on the land in rows, so as to admit the dung cart on each land, to manure for a succeeding crop of turnips.

On the 25th, the heads were brittle enough to be readily crushed with the foot; and on that account were considered ready for thrashing. They were, therefore, picked from the stalks, and carried to the centre of the field, at 3*d.* per bag of 6 bushels. They were fortunately secured by a large rick cloth from the rain, which fell in abundance next day.

August 27th. The whole crop of heads was thrashed on the spot in four hours, by a machine of 4 horse power; the seed (a sample of which is sent) was separated by coarse riddles, and afterwards perfectly cleaned by a sieve just coarse enough to permit the seed to pass through, while the dust was blown away by the wind fan. The seed weighed 13 cwt. which we expect to produce 5½ gallons of oil per cwt.

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The straw being removed, and the dung spread and ploughed in, the field was sown with stone turnip seeds, between the first and seventh of September. They did very well, and having been fed off with sheep, the land has received a ploughing preparatory for a *fourth* crop of poppies, which will be sown in the middle of this month after another furrow.

We now request permission to make some additional observations, which we have not been able with convenience to interweave in the preceding narrative, and which may be necessary if the paper should at any time serve as a guide to a beginner in the poppy cultivation.

The soil on which our experiments were made, is a good loam on a sandy subsoil; it had been much exhausted by perpetual white crops and other bad husbandry, when it was prepared in the Autumn of 1818 for poppies; it was then under wheat stubble, and so completely occupied with the roots of couch grass, as to form a perfect mat.

In this state it was ridged up in furrows, merely deep enough to bottom the couch grass; each furrow was then pulled separately down with rakes, containing five 6 inch teeth, this brought the couch to the surface, from whence it was carted off in immense quantities; insuperable obstacles presenting themselves to burning it on the land.

The land now appeared perfectly clean, and after another ploughing, the greater part of it was sown without manure, with white poppy seed, which survived the succeeding winter. The annuals had been allowed to shed their seeds during many preceding years, and they now came up as thick as mustard or cress in the garden; amongst these the *alsine media* (chickweed), and the *Polygonum persicaria* (knot-grass), were pre-eminent; they were destroyed by the hoe in the Spring, but each succeeding ploughing excited

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an equal abundance of successors into vegetation, until last year, when this number, though still very great, was sensibly diminished. These circumstances are mentioned, to show, that although foul land is a great obstacle to the cultivation of the poppy, yet it is not an insurmountable one.

The other portion of the field was sown in the following February, with a portion of the same seed, and had a liberal allowance of manure. The Winter poppies grew very slowly until the end of May, when they obtained a decided superiority, which they preserved to the last; adding another proof to many observed before, that poppies sown in the Autumn, without manure, are superior to those sown with that advantage in the Spring.

It should, however, be known that the *papaver somniferum* will not always bear the severity of our Winter: and that hares, where they abound, will certainly eat it during the Winter.

We have observed, that poppies are cut off rather by sharp winds than by still frost, however severe. As a protection, last Autumn we drilled turnips thickly in each interval at the time of sowing (Sept. 7th); these grew up much above the poppies, which have hitherto withstood the Winter. This, however, may be accounted for by the mildness of the season, without referring to the agency of the turnips; still the experiment certainly deserves to be repeated.—This piece measures 6 roods.

The manures employed were composts of night-soil and road drift, the dung of horses and of hogs, and street manure.

The scarificators should be attended to carefully; they ought to cut deep enough to make the juice flow from each incision; but if they penetrate the cavity of the

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head, much mischief is done; a channel by no means desirable is formed for the opium, while the growth of the head is checked, and the seed exposed to ruin from the rain. The smaller poppies must be examined at the first operation after each scarifier. They should be squeezed betwixt the thumb and finger, and if the wounds are too deep, the air from within the head will escape, bubbling through the milky juice.

The knives must be kept very sharp; our's were ground every morning, and finished on the hone.

The receivers should have sharp edges, the more effectually to clear the knives.

It should have been remarked, that when the scraper follows the scarifier too quickly, a fresh exudation takes place. When this happens, the children scrape them again in the morning, whilst fresh work is provided them by the scarifiers. Warm days, and parts of the day, promote the exudation greatly.

No particular application has yet been discovered for poppy oil, excepting as a vehicle for the colours of artists. The oil cake we have given to pigs with great advantage; and have information of good success from stall-feeding cattle with it; the seed itself, perhaps, contains more nutriment in a given weight than any other vegetable production.

The capsule of the poppy, after producing opium, yields, by cold infusion, an extract, of which we send a specimen; eight grains of it are fully equal to one of opium. No considerable demand for it exists; an acre produced 80*lb.* of this extract.

Notwithstanding the apparent stubborness of the poppy straw, it makes excellent manure, when well trodden in the yard, and laid in a compact head to ferment.

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The quantity of opium consumed in this country, is supposed to amount to about 40 to 50,000 *lbs.* exclusive of that which is exported. This quantity, our experiments have convinced us, could be easily raised in many parts of Great Britain, where good dry land, and a superfluous population happen to exist together. On the moderate calculation of 10*lbs.* per acre, that quantity would only require 4 or 5,000 acres of land, and 40 to 50,000 people.

As far as such a limited employment can go, a general cultivation of opium would certainly be beneficial by calling into action a description of persons not calculated for common agricultural labour, and that between hay-time and harvest. The duty of 8*s.* 8½*d.* on foreign opium, would secure a profit on opium consumed at home, as it must add at least 11*s.* per lb. to the price of the foreign.

Our experiments have taught us, that the opium season may be extended to six weeks and upwards, by one autumnal and two or three vernal sowings.

At present, scarcely any demand exists for British opium; but the article has been introduced to the attention of the College of Physicians; and should that learned body think proper to give it a place in the Pharmacopœia, the currency thereby stamped upon it, will soon bring it into use. We confidently expect, that the British will soon be sought for in preference to the foreign opium, and consequently bear a higher price. This opinion is founded on the numerous and highly favourable reports we have received from eminent medical practitioners; and confirmed by the result of our own experiment of its effects; having administered many pounds of it during the last three or four years.

To conclude, Sir, if the Society feels desirous to publish this paper, we shall be extremely ready to give more par-

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ticular information, on any part which the Society may not consider sufficiently explained.

In consequence of being engaged in the cultivation of other medicinal plants, we have to regret our inability to offer the Society an account of the precise total of expense incurred last year by the cultivation of opium; we were not apprised of the Society's intentions until October. Where the expenses are stated, they may be relied upon as correct. We have omitted to state, that we calculated the deficiency in the crop, at a fourth part, and that we believe an acre may produce at a *maximum* upwards of 20 *lbs.* of opium.

We are, Sir,

&c. &c. &c.

JOHN COWLEY, *Member of the Royal College of Surgeons.*

WILLIAM STAINES, *Surgeon.*

A. Aikin, Esq.

Sec. &c. &c.

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TABLE I.

Showing the daily Progress and Expense, in the Year 1820.

Days.	Number of Persons.	Quantity.			Expense.		
1820.		*lb.*	*oz.*	*dr.*	*£.*	*s.*	*d.*
July 19.	2 Women	—	4	4	—	2	—
20.	7 D°.....	—	9	—	—	7	—
21.	7 D° viz. N°. 1...	—	8	4			
	— 2...	—	5	8			
	— 3...	—	5	12			
	— 4...	—	5	12		7	—
	— 5...	—	5	8			
	— 6...	—	3	14			
	— 7...	—	—	12			
22.	11 D°.....	1	15	8	—	11	—
24.	10 D°.....	2	13	—	—	10	—
25.	11 D°.....	3	6	—	—	10	6
26.	11 D°.....	3	11	12	—	11	—
27.	11 D°.....	1	10	12	—	11	—
28.	4 D°.....	0	15	—	—	4	—
29.	4 D°.....	1	2	12	—	4	—
31.	4 D°.....	1	1	—	—	4	—
Aug. 1.	4 D°.....	0	11	4	—	4	—
2.	4 D°.....	1	—	8	—	4	—
		21	8	2	4	9	6

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TABLE II.

Showing the daily PROGRESS and weekly EXPENSE in the Year 1821, with the general state of the Weather.

Days.	Weather.	Quantity.			Expense.		
1821.		*lb.*	*oz.*	*dr.*	£.	*s.*	*d.*
July 24.	Showery	5	1	—	—	—	—
25.	D°.....	9	—	—	—	—	—
26.	D°.....	11	—	—	—	—	—
27.	D°.....	14	—	—	—	—	—
28.	Fine all day.....	14	—	—	8	13	1½
30.	Showery	5	—	—	—	—	—
31.	Constant Showers ...	7	—	—	—	—	—
Aug. 1.	Fine	7	8	—	—	—	—
2.	Showery	4	12	—	—	—	—
3.	Hot and dry	8	—	—	—	—	—
4.	Fine.....	2	12	—	15	1	6½
6.	Tolerably d°	2	12	—	—	—	—
7.	Fine	4	8	—	—	—	—
8.	Rained hard all day...	—	—	—	—	—	—
9.	Showery	1	12	—	7	16	6½
		97	1	—	31	11	2½

SIR; Winslow, April 15th, 1822.

IN reply to your letter, of the 16th ult. requesting "a particular account of the method of constructing the scarificator" employed by us, we transmit to you the following particulars:

Entirely unused, however, to describe mechanical operations, we rely on your pardon, if through our anxiety to be sufficiently particular, we risk the misfortune of becoming somewhat tedious; we do so with the more confidence, from an impression that your memory will present

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you with instances, in which descriptions of very simple operations, have been rendered perfectly unintelligible, by want of attention merely to minutiæ.

We send you the only two instruments employed in the construction of scarificators, that are possessed of any peculiarity. The other requisites consist of a small step grind-stone (if with an apparatus for supplying water, much the better), a bench with a small vice affixed, and a light hammer.

With respect to the most proper kinds of wood, our experience only enables us to speak of three; beech, mahogany and oak. Of these, beech is considerably the best; having a mixed grain, it holds the blades with much tenacity: mahogany can be worked with more facility than beech, but wanting the transverse fibres of the latter, it is less tenacious of the steel: oak holds the blade with sufficient firmness, but the direction of its longitudinal fibres, is very uncertain and irregular; hence it often happens, perhaps when the instrument is nearly finished, that a blade is thrown out of its proper course, and the whole by that means rendered useless; this quality renders the employment of oak very objectionable.

It should be observed, that scarificators of one dimension, are sufficient for poppies of all sizes, the elasticity of their capsules permitting them to adapt themselves to the figures of the scarificators; the latter should, however, be so constructed as to fit a poppy of an average size, in order to equalize the difficulty of accommodating them to the two extremes. The medium of size, we believe, is occupied by capsules two inches and a half in diameter; on which account, the faces of our scarificators are formed of segments of a circle of that diameter.

The hafts are furnished by the carpenter, plain, at 1*s.* 6*d.*

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per dozen; in this state they are supposed to be, at the commencement of our description of the construction of scarificators.

The first thing to be done is, to give to the part into which the steel teeth are subsequently to be inserted, a curve, corresponding with the arc of a circle, two inches and a half in diameter (see the left-hand figure 2, Plate I.): then, by means of a fine saw, made of watch-spring, make five equidistant cuts in the head of the handle, in a longitudinal direction, for the reception of the blades.

In order to save the great expense of forging and finishing a number of so small blades, we have been induced to employ broken watch-springs, for their formation, and have found them answer extremely well:—The manner of using them is as follows:—

A spring is to be brought to an edge by the grindstone, continually moving it, if the stone be dry; about one-sixth of an inch is then to be broken off with the pliers (assisted by firm pressure with the thumb) in an oblique direction, so as to leave the end of the spring possessed of an angle of forty-five degrees; the irregularities of the fracture are to be ground off, wetting the point frequently if the stone be dry, to avoid such an increase of temperature as would destroy the blue temper of the steel.

After the grindstone the hone must be used, to finish about as much of the point as is intended to project from the wood.

The handle is now to be fixed in the vice, and the spring (being previously wetted at the end with water) to be gently driven by means of a light hammer, into one of the cuts previously made by the saw, allowing the sharpened point to project about one-thirtieth part of an inch; the remainder of the spring is then to be broken off, by pressing

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it with the thumb firmly down to the wood, close to which it should separate with an even fracture. The blades being thus successively fixed, the hammer must be employed to batter down the wood gently about them. The end and back being then applied slightly to the grindstone, the scarificator will be finished, and, notwithstanding the apparent slightness of the attachment, not one blade in a hundred will become loose.

If mahogany be used, a little sulphuric acid should be added to the water into which the blade is dipped previous to its insertion into the wood, and as soon as finished, must be placed with its head in a mixture of chalk and water, in order to neutralize the acid, which would otherwise attack the points and edges of the blades.

We should have stated, in our first communication, that two scarificators should be provided for each person; distributing the second supply, when the capsules become (as they will) somewhat tough; an industrious person, in a dry season, will even wear out three of these implements.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec, &c. &c. WM. BLOW STAINES.

CERTIFICATES.

Winslow, February 2nd, 1822.

I DO hereby certify, that Messrs. J. Cowley, and W. B. Staines, obtained, in the year 1821, sixty pounds and one ounce, of solid opium, from the *papaver somniferum* raised

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by them in this parish, and that the whole of it was in every respect equal to the specimen, No. 12.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec., &c. &c. C. KIPLING.

SIR; Harley-street, February 5, 1822.

I BEG leave to certify, that I have made frequent trials of the English opium, prepared by Messrs. Cowley and Staines, at Winslow, Bucks, and that I am convinced it will do every thing that we usually expect from the use of foreign opium.

I am, Sir,

&c. &c. &c,

J. LATHAM.

2, Newman's-row, Lincoln's-Inn-fields.

SIR; 5th February, 1822.

I TRUST I am not departing from the regulations of the Society for the Encouragement of Arts, Manufactures, and Commerce, in requesting you to lay before it, my testimony in favour of the English opium cultivated by Mr. Cowley, of Winslow, in Buckinghamshire.

I have been in the habit of prescribing it in my own practice for upwards of twelve months, and am satisfied that its properties are, in every respect, equal to those possessed by foreign opium, and that its purity is greater than that of foreign opium.

It may likewise be necessary I should state, that I have furnished two persons, the one with opium, and the other with tincture of opium, who have, for some years, been in the constant habit of taking it in those forms. By the former (a labouring man), I have

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been told, that he cannot distinguish any difference between the effects of it, and of foreign-opium; whilst the latter, a gentleman of considerable literary attainments, and whose papers on the subject of opium-eating, contained in the London Magazine, of September and October last, will show how far his opinion is entitled to attention, this gentleman has distinctly stated, that he has failed to produce the same effects with one hundred drops of the tincture, made from Turkey opium, as those which he had previously produced, by the same quantity of tincture made with Mr. Cowley's opium. In laying these facts before the Society, I consider I am but performing a duty.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. THO. CLARKE, *Surgeon, &c.*

28, Parker Row, Dockhead,
November 5th, 1821.

GENTLEMEN;

I RECEIVED your communication respecting the British opium, but was prevented by professional engagements from giving you an earlier answer, which I should otherwise have cheerfully done.

I have employed scarcely any foreign opium these last six months, when I began with yours, excepting in physical prescriptions, and have used nearly the four pounds I received of you, in my practice.

Your inquiries as to the result of my experience of the medical properties of it, I feel enabled to answer with confidence, for the obvious importance of the subject has led me to a careful observation of its effects.

My opinion is, that your opium is in no respect inferior to the best Turkey opium. I consider it far superior to the

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greater part imported. Its extraordinary purity must be, and is, very much in its favour; the foreign is evidently a very heterogeneous mass, perhaps partially from the slovenly mode of collecting it, and partially from adulteration, the comparison of different specimens will demonstrate that it is so in various and uncertain degrees; on the last account, I believe, the employment of your opium is likely to be most advantageous, being more uniform and certain. It is my opinion, however, that the sanction of the College of Physicians will be necessary, to give it the requisite degree of currency with the profession.

I perfectly agree with you respecting the national advantage likely to be derived from the extended cultivation of opium in this kingdom, for although I cannot pretend to extensive knowledge of the comparative advantages of foreign and domestic trade, I yet venture to suppose, that British capital can no where be better laid out than in the employment of British subjects, in a way peculiarly suited to such as are too old, too young, or toc weak, for common agricultural labour.

I remain,

&c. &c. &c.

Z. DUNKIN.

P.S. If these few observations can be any way serviceable to you, use them at your pleasure.

Brackley, December 1st, 1821.

I HAVE tried the opium prepared by Mr. Cowley, of Winslow, and find it in effect, equal to the finest Turkey.

FREDERICK GEE.

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13, Bedford Row, February 5th, 1822.

I BEG leave to state to the Society of Arts, &c., that I have both ordered the use of Mr. Cowley's opium in my own practice, and recommended its employment to others; and that both myself and friends have found it *at the very least*, equal in efficacy to the opium met with in the shops. Indeed, we have rather thought it to possess superior power to the common Turkey opium.

DAVID UWINS, M.D.

Nº III.

PRESERVING TURNIPS DURING THE WINTER.

The large GOLD MEDAL, *the premium offered, was this Session presented to Messrs.* COWLEY *and* STAINES, *Surgeons, Winslow, Bucks, for their successful method of preserving the* ROOTS OF TURNIPS *in a state fit for feeding cattle therewith, during the months of February, March, and April. The following communication has been received from the Candidates, on the subject.*

Winslow,
April 27th, 1822.

SIR;

THE purport of the following paper is, to communicate to you, for the consideration of the Society of Arts, a method we have successfully employed for the preservation of turnips during the last Winter; in consequence of

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which, we request permission to offer ourselves as candidates for the Society's premium, No. 35, for the "Preservation of Vegetable Produce."

The two fields in which our turnips were sown, measured (as will be seen by Mr. King's survey) four acres and upwards, exclusive of fences, &c. The soil in both is a dry loam, and was in good condition, although not manured for the turnips; two ploughings only were allowed, one in the preceding Autumn, the other in the Spring.

Between the 10th and 15th of last May, the seed was deposited in drills 21 inches apart, and we think about one deep. Very nearly ten pounds of seed were used, with hopes that enough plants might escape the turnip-fly. The seed came up very favourably, in great abundance; yet the fly, which soon commenced its ravages, destroyed so many, that it was necessary to procure plants from other quarters, before all the vacancies could be filled by transplanting; this was performed between the 3rd and 7th of July, with favourable showers, but was rendered partly abortive by dry weather immediately succeeding the last day of planting, so that, eventually, the crop was considerably imperfect.

On the 10th of November, we began pulling the turnips which were all carted home before the end of that month, and the land immediately sown with wheat, which now promises extremely well. The crop was removed thus early, in order to demonstrate that our plan would permit wheat to succeed the turnips, and with the hope of influencing the Society in its favour on that account.

A man and two boys were next employed to cut off the tops, leaving the roots undisturbed, with particular instructions not to remove the crown, or any part of the

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neck, even although the latter should be of considerable length. This caution we considered highly important, because in all cases where the decay of turnips, carrots, beets, or mangel wurtzel, has fallen under our observation, such roots as were destitute of crowns, have soonest and most frequently fallen into decay. Now, the causes of this propensity to decay, which such mutilated roots do certainly possess, appeared to us deserving of investigation; we have accordingly bestowed some attention upon the subject, and beg leave to offer the result of our inquiries.

We have imbibed an opinion that wounds in any part of bulbous roots, in some measure increase their tendency to decay; but their influence is very slow and uncertain compared with such as remove the crown. At the crown the leaves are united to the bulb, and, somewhat within the bark of the latter, future separation will take place at a point in no way influenced by the length of pedicle left on cutting off the leaves. These points may be seen distinctly in the form of small cavities, on examining a turnip whose crown is lengthened into a neck. The leaves of the turnip are annual, although the bulb is biennial; the first year's crop of leaves are shed during the first Summer and succeeding Winter; in the next Spring, if in the field, or immediately, if stacked or housed, one fresh shoot or more will be produced in most of the eyes or cavities, consisting of many leaves, precisely in a similar manner to the production of buds on trees after the leaves of the preceding season.

The production of this shoot is, we think, a great preventative of decay in the root, for the latter, being still in a living state, requires the function of respiration to be performed by its bark and leaves; this function, the latter,

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assisted by their youth, will carry on to a considerable extent. On this account it is, that we insist so much on the necessity of preserving the crown, whose agency appears to us essential, as it contains the rudiments of those buds which we consider so efficacious as organs of respiration.

To proceed with the description:—After the leaves had been removed, as many turnips were thrown together as would readily lie upon a circle 4 yards in diameter; *yealms* of wheat straw were made, similar to such as are used for thatching, but longer, thicker, and formed with less precision; four tall stakes were then driven into the earth, each a yard from the heap, so as to form a square, each side of which would measure six yards.

Two courses of yealms were next placed on the earth, so as to inclose the quadrangle indicated by the stakes, and in such a situation, that a line drawn from one stake to the next, would divide them transversely into two equal portions. Large turnips being selected for the sake of expedition, a single row of them was placed along the middle of the yealms, in a line with the stakes, which served as guides to the proper position of the row; the *upper* course of yealms was next turned up over the turnips, a boy being employed to place a second row of smaller turnips immediately within the first, in order to press down and confine the ends of the yealms; turnips having been thrown in by the basket-ful, until the new work had a slight and regular descent towards the original heap: two more courses of yealms were laid on, and treated as the first.

This process was continued until about two thirds of the turnips had been disposed of; the outside, or wall, was then perpendicular, and possessed so much firmness, that a man could walk round the extreme edge without dis-

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composing it in the least, so that it might have been raised in that direction to an indefinite height.

With the remaining third of the turnips, the top of the stack was brought into a pyramidal form, by making each succeeding course incline gradually towards the centre, until the top was about four feet wide, when it was brought to a point with the refuse straw, and surmounted with a flat stone. Each *under* course of yealms having been left undisturbed, they formed a thatch, as neat and impervious as the one usually placed upon barns, &c. Had the Winter even proved very severe, the thick and close coat of straw which inclosed the turnips, would, we are persuaded, have afforded them abundant security.

Between the 5th and 10th of February, we purchased six barren cows to consume the turnips, the number was, however, soon reduced to five, by an accidental death; these have been fed with the turnips to the present day, excepting two, one of which was sold on the 5th instant, the other on the 16th instant; both ate turnips until sold.

On re-perusing, in March, the Society's conditions, the feeding of sheep appeared to be an essential one; two wethers were therefore added to the feeding stock, in March.

The stack was opened on February the 6th, when the contents were found to be perfectly sound; and, although the turnips were as wet as possible when stacked, the earth upon them was then perfectly dry; this, perhaps, may account for their growing so little, which the peculiar mildness of the season, and the early period of stacking, had left us little room to expect; this supposition is confirmed by the circumstance of the lowest stratum being considerably grown, having shoots, perhaps, six inches high; whilst the other strata had, in general, merely little

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buds, which have scarcely yet grown into shoots two inches long. These facts show the impropriety of stacking on the wet earth, which should be covered with straw or brushwood.

The cows improved rapidly on the turnips, they ate, when accustomed to them, from 2 to 2½ bushels each, per day; the roots were cut into convenient pieces, scraping such as happened to have earth adhering to them. The sheep also improved a good deal, but being put up so late, and that, too, in a very lean condition, some grass will be required to finish them for the butcher.

From the irregularities of our crop, we could not hope to state the average to the Society with the requisite accuracy, without measuring the whole produce; this was found to amount to 986 bushels, weighing 60 lbs. each, and thus affording an average of 1,380 lbs. to the 16 perches. The expense was as follows:—

	s.	d.
Two men, 1 day each	2	6
Two boys, do. do.	0	8
	3	2

The expense of pulling and topping was more than repaid by the value of the tops for pigs; 17 cwt. of straw were used, but it received no injury, and was employed to litter the cows.

Although not enjoined by the Society's conditions, we have sent the last remnant of our stack, hoping it will corroborate our statement of its soundness.

JOHN COWLEY.
WILLIAM STAINES.

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CERTIFICATES.

Whaddon Hall, April 27th, 1822.

THIS certifies, that I inspected Messrs. Cowley and Staines's, stack of turnips, which was constructed according to the preceding description, and saw the turnips as lately as the first week in April, when they were perfectly sound, and in every respect fit for supporting sheep and neat cattle.

W. SELBY LOWNDES.

Winslow, April 27th, 1822.

THIS is to certify, that, in November last, I measured Messrs. Cowley and Staines's turnips, and found the quantity of land to be 4 acres, 1 rood, 3 perches, exclusive of fences. I have also positive knowledge that the whole crop was carted home before the end of that month.

JOHN KING, *Land Surveyor.*

Winslow, April 27th, 1822.

THIS is to certify, that in the first week in February last, I purchased for Messrs. Cowley and Staines, six beasts, and afterwards, two sheep; which, to my knowledge, have been fed upon turnips preserved in a stack, built according to the before-written plan; and that the said beast and sheep (excepting a heifer, which died accidentally), have constantly been thriving, and going on well, until the present day, respectively, as they have been sold.

GEORGE MAYDON, *Butcher.*

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N° IV.

HAY BORER.

The Large SILVER MEDAL *was this Session presented to Mr.* ARTHUR BIDDLE, *of Playford, near Ipswich, for an* INSTRUMENT FOR BORING HAY-STACKS. *The following Communication has been received from the Candidate on the subject, and the Instrument itself is in the Repository of the Society.*

SIR; Playford, Suffolk, May 1822.

I HAVE taken the liberty of sending, for the inspection of the Society, a machine invented by me in 1815, for the purpose of boring haystacks, either in a vertical, or in any other direction, in order to give vent to the heat, when they are in danger of firing, or for drawing samples when they are offered for sale. After trying several plans without the desired success, I invented the instrument accompanying this communication, and allowed a maker of edge-tools in this village, Wm. Wright, to make what advantage he could of the invention. He accordingly made several instruments, till his death, which happened two years ago, and disposed of them in this neighbourhood,

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and in Essex, where they have given satisfaction, as appears from the annexed certificates.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. ARTHUR BIDDLE.

CERTIFICATES.

Culpho-hall, near Ipswich, Suffolk,
March 26th, 1822.

SIR;

FOR a great number of years past, a great deal of hay, and clover, stover, &c., &c., have taken much hurt, by over-heating, and recourse has been had to methods for letting out the heat from the stack, such as drawing a sack up the middle of the stack; laying a number of wood-faggots across, &c. &c., in order to prevent its turning black (which is often the case), and so, entirely spoiled. I have seen a stack so overheated, as to be good for very little, excepting the two ends of the stack. About seven years ago, Mr. Biddle of Playford, near Ipswich, Suffolk, invented an instrument for boring holes, in any direction, through any stack, or perpendicular, according as it was wanted or thought to be proper.

In the month of July, 1815, I sent for one of these instruments to a Mr. Wright, a blacksmith, whom Mr. Biddle employed to make them (and as I have always understood, Wright had permission from Mr. Biddle to make, and take the profit of them, as long as Wright lived). With this instrument, I found I could bore through the stack in any direction, in a few minutes (a stack of about fifteen tons); which I found of great use and benefit, to preserve the stack from over-heating; and

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I am fully persuaded that many stacks, which have been over-heated, and literally spoiled, if recourse had been had to Mr. Biddle's hay-borer, might have been excellent hay. I only speak of circumstances that have come under my own notice, and therefore, can vouch for the truth of what is here communicated, and for the utility of the instrument.

I am, Sir,
&c. &c. &c.
JOHN THOMPSON.

A. Aikin, Esq.,
Sec., &c. &c.

CERTIFICATES to the same effect as the preceding, were received from Mr. J. P. Meadows, of Berherst House, Witnesham, Suffolk; Mr. Richard, and Mr. Robert Ashford, of Witnesham Hall; Mr. T. Flory, and Mr. Charles Poppy, also of Witnesham; and Mr. J. Bark, of Milton, near Peterborough.

The Agricultural Committee of the Society of Arts, also had an experiment performed under their inspection, on the premises of Mr. Rhodes, Tottenham-court-road, which afforded a very satisfactory result.

Description of the Instrument.—Plate II.

FIGS. 1, and 2, represent the Borer, one-sixth of the real size: it may be compared to a solid cork-screw, only that the blade is wrapped round the rod, and does not form a part of it. The rod from *a*, to its point *b*, is made round and taper. The blade at its lower extremity is formed into an eye, which is secured to the rod by means of the screw *c*; from this point the fin, or cutting edge,

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gradually increases in width, and is wrapped round the rod, at equal intervals, to the point *a*, where is formed a square hole, for the rod to pass through, as shown fig. 3, and in which it is secured by the screw *a*, fig. 2; the rod being in this part made square to fit the hole. From *a* to *d* the cutting edge is broad, and nearly at right angles with the rod; the part *d e*, is turned up, nearly at right angles to the preceding, and is curved, as if it were cut out of a cylinder, so that every part is equally distant from the axis. This part of the cutter must necessarily be longer than the distance between the spirals, otherwise the cuts would not be united; the edge also is made to slope backwards, as shown *d e*, fig. 5, in consequence of which form, it gives a drawing cut, and thus divides the hay with great facility.

The rod is cylindrical, about twelve feet long, and three-fourths of an inch thick; it is turned by a cross-handle, *ff*, fig. 6, and may be secured at different distances, according as the instrument advances into the stack, by means of the screw *g*, taking into the holes *h h*, which are sunk to the depth of about a quarter of an inch. In the end of the rod is a square hole or socket, for the purpose of fastening on another length of rod, the projecting end of which fits into the socket, and is there secured by a screw.

The other part of the apparatus is the drawing screw, *i k*, fig. 1., the diameter of which is nearly equal to that of the hole made by the cutter, and by means of it the plug of hay, detached by the knife, is drawn out.

Figs. 3 and 4, represent the cutter as seen parallel to the axis of the rod, and looking from or towards its point.

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Directions for using the Instrument.

FIRST cut away the loose hay, where the borer is intended to be applied, then insert the point of the borer, and by means of the cross handle turn it round, till the stack is pierced either quite through, or to a sufficient depth; then withdraw the cutter, and by means of the drawing screw repeatedly applied, take out the plug of hay which has been detached. If, however, the hay be in a moist, heating state, it will occasionally coil round the cutter in proportion as it is pierced, and impede its action. In such cases, the drawing screw must be slipped over the rod of the cutter, as shown fig. 1., and must be applied from time to time, to draw out the hay, in proportion as it is detached from the mass.

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PAPER

IN

POLITE ARTS.

ENGRAVING IN MEZZOTINTO ON STEEL.

The GOLD ISIS MEDAL *was this Session given to Mr.* LUPTON, *of Leigh-street, Burton Crescent, for a Portrait in* MEZZOTINTO ON SOFT STEEL. *Two impressions from the Plate, are in the possession of the Society, and the following Letter on the subject has been received from the Candidate.*

7, Leigh-street, Burton-Crescent.
November 1st 1822.

SIR;

SINCE I had the honour of receiving the Gold Isis Medal of the Society, for an engraving in Mezzotinto, on a steel plate, I have had many opportunities of ascertaining its decided superiority over copper-plates. As certain

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circumstances prevented my printing the plate of Mr. Munden to any extent, I lost no time in producing another steel plate, which was destined to undergo a fair trial, and in this particular it fulfilled my most sanguine expectations; fifteen hundred copies have been taken off; and, in order that the Society may have the fullest opportunity of judging of the durability of steel plates, I send along with the Portrait of Mr. Munden, two impressions of the plate above mentioned, one of them a proof before the writing, the other one of the last of the fifteen hundred. An impartial view of these will set the matter quite at rest. It is difficult to conceive, what number this plate would produce, if printed until it was worn out. I have no doubt, however, that steel plates in Mezzotinto, will produce eight or ten times the number of those engraved on copper. It may perhaps, be expected, that some novelty, in the mode of executing the steel plates, would be now elicited, but in strict truth, there is little or nothing to be said on that point; the same tools are used, and the same mode of executing adopted as upon copper plates, the only difference I know of is, that greater strength must be used in laying the Mezzotinto ground; indeed it requires a very strong hand, and a greater number of ways.* I have laid as many as ninety ways on some plates, whereas, on copper, the usual number is from twenty-four, to thirty-six, or forty. As to the making of steel plates, I conceive this art to be quite in its infancy; however, several intelligent men are engaged in it, and I presume we shall not long meet with any difficulty; at present I have nothing further to observe, than that great care is necessary to pre-

* A *way* is going once entirely over the plate with the grounding tool,

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vent the plates taking rust; I have met with one or two serious accidents in this way: I believe it would be a matter worthy the consideration of the Society, to offer a reward for an acid, for etching on steel, as that now seems to be the chief difficulty in its way.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec., &c. &c. THOMAS LUPTON.

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CHEMISTRY

AND

MINERALOGY.

GLAZING FOR COMMON RED EARTHENWARE.

The Large GOLD MEDAL, *being the premium offered, was this Session given to* J. MEIGH *Esq., of Shelton, Staffordshire, for a* GLAZE FOR VESSELS OF COMMON RED EARTHENWARE, *not prejudicial to the health of those who make use of them. Specimens of the Ware, so glazed, and of the glaze itself, as well as of the ingredients of which it is composed, are placed in the Repository of the Society.*

THE common coarse red earthenware is made of brick clay, hence it is very porous: it is also baked at as low a heat as possible, partly in order to save the expense of fuel, and partly, because being made of common clay, which varies considerably in its fusibility, it will not always bear

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a high firing, without losing its shape, and becoming unsaleable.

For the reasons above-mentioned it is necessary to employ a glaze, fusible, cheap, and capable of filling up the pores of the ware, so as to enable it to hold fluids, in ordinary use, either as articles of food, or of domestic employment. Litharge, and the common potter's lead ore, are the articles usually employed, the one for the transparent, the other for the black opake glaze. The objections, however, to a glaze wholly or in part composed of lead, are, first, that it cracks when raised rapidly to the temperature of boiling water, on account of the different ratio of expansibility, between the glaze and the clay, and then admits the liquor into the body of the ware; secondly, the glass of lead by itself, or even when mixed in small proportion with earthy substances, is very soluble in vinegar, in the acid juices of the common fruits, and in animal fat when boiling. When such substances, therefore, are cooked in vessels of common red earthenware, a quantity of salt of lead, is formed, which, mixing with the food, produces violent cholics, and all the serious, and often fatal effects that attend the internal administration of the salts of lead.

The discovery of a better and more wholesome glaze, sufficiently cheap to be applied to the common red ware, appeared to the Society to be an important desideratum, and in their opinion this is now effectually supplied by the discovery about to be detailed.

The rock called red marl, is usually in the form of beds of a soft, coarsely slaty structure, and red colour, forming the chief part of the common soil, in many extensive districts in this island, to the N. and W. of a line running obliquely from Durham to Exeter. This marl is easily ground

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in water to an impalpable powder, which remains suspended for a considerable time in the fluid. A mixture of this kind is prepared, and the ware, previously well dried, but not burnt, is immersed in it. The superficial pores of the clay are thus filled with fine particles of the marl, and a fit surface is prepared on which to lay the glazing. Being again carefully dried, the ware is ready for the glaze, which is thus composed,

Take 1 part Cornish Granite, consisting chiefly of Felspar,
1 part Glass.
1 part Black Manganese,

the whole well ground together, and diffused in water, to the consistence of cream. Dip the ware in this mixture, and, when thoroughly dry, place it in the kiln and fire it in the usual way. The result will be, a solid black glaze, very permanent, and not containing any ingredients noxious to health. If an opake white glaze is required, omit the manganese.

Mr. Meigh has also employed common marl and the red marl as ingredients of the body of the ware, with excellent effect without increasing its expense; he uses for this purpose, 4 parts of common marl, 1 part of red marl, and 1 part of brick clay. Vessels made of the above mixture, are in possession of the Society. The colour of the body is a reddish cream brown, it is harder, more compact, and less porous than the common red ware; and its general adoption, with the above mentioned glaze, would contribute in no inconsiderable degree to the health of the lower classes, by whom alone the common red ware is used for vessels of cooking.

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N° II.

TUSCAN MILL-STONES.

The Large SILVER MEDAL *was this Session given to* HENRY WILLEY REVELEY, *Esq. for his Communication, respecting the nature and preparation of the Stones used in Tuscany, for Grinding fine Flour. Specimens of the Stones have been placed in the Repository of the Society.*

King-street, West, Bryanstone-square,
Dec. 11th, 1821.

SIR;

I TAKE the liberty of offering to the Society some specimens of mill-stones, from Tuscany, which I beg you to lay before them on the first convenient opportunity. Having detached them myself from stones of tried quality, I can answer for their being genuine; and such as are most esteemed, and most generally used. From the great difference which exists between these stones and the French burr-stones; and the certainty of their being capable of producing flour equal both in quality and quantity to that afforded by the latter; I presume it might be worth the trouble of ascertaining, if similar stones are to be met with in this country.

The specimens marked No. 1 and No. 2 are used for producing white flour only. No. 1 is from the upper or running mill-stone. It is diallage rock, consisting of

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crystals of diallage, imbedded in apparently, compact felspar: both ingredients are so soft as to yield without much difficulty to the knife, but the various position of the crystals of diallage, and their very distinct lamellar structure, always preserve a certain degree of roughness, even after long-continued friction. This rock forms a hill at Prato, a few miles from Florence. The stones, while in the quarry, are first shaped out with a pick, care being taken to make the face of the stone perpendicular to the plane of the bed of the rock; they are then detached bv driving in wedges of soft dry wood, between the stone and the adhering mass; finally, water is thrown upon them, which, by increasing their bulk, detaches the stones.

No. 2, is a compact, porcellanous limestone, of a pale flesh colour, and somewhat softer than the diallage rock.

No. 3, is a granular talcose quartz, with imperfect imbedded garnets; it is the material of which both stones are formed for producing brown flour. The only preparation that the corn receives previously to grinding is washing. For this purpose, a basket is sunk into a tub of water, and the corn is slowly poured into the basket: the light grains and dust are thus brought to the surface, and are removed; and the corn having been dried in the air and sun, till it is only very slightly damp, is ready for the miller's use. In this state, less flour is lost in the form of dust, and the grains being somewhat softened externally, the bran is more easily disengaged in broad flakes without any flour adhering.

I shall be happy to communicate to the Society, any more detailed information in my power to give them on this subject. I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. HENRY W. REVELEY.

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Description of the Engraving.—Plate VIII.

Fig. 1 represents the face of the under mill-stone prepared for work; the teeth, to possess their utmost perfection, should have the form of the hyperbolic spiral; but, being cut by the hand of the workman without any great regard to mathematical precision, they will, in general, be found to be portions of circles, the locus of the centres of which would be the periphery of a circle of the radius of fourteen inches, described from the centre of the mill-stone. The tool employed to cut the teeth is a double-edged hammer, four inches wide, very sharp, and weighing about twelve pounds; in general, the teeth are as close as possible to each other, but in approaching the eye, they become more rare, deeper and coarser. When the stones are new from the quarry, a few days only are necessary to complete this operation; but when they have been already in use, any able miller's man, wholly unassisted by others or by machinery of any kind, will complete it in the course of twenty minutes. That part of the face which is the real grinding surface (called by the Italians, "*il vero macinante*") extends from six to eight inches from the circumference of the stone. Fig. 2 represents a section of the mill-stones when set to work; the dimension usually preferred, equally for the most powerful mills as for those of inferior strength, is a diameter of four feet, that of the eye being about seven inches. The face of the upper stone is hollowed to a conical surface, the altitude of the cone being about one inch and a half, while that of the lower stone receives a convex form, its surface

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approaching to that of a sphere of which the radius is about thirty feet, leaving a distance of about one inch between the centres of the two faces. The deep socket let into the runner, as indicated by fig. 2, is made for the reception of the iron nut placed on the square of the spindle. The runner is balanced, and rendered parallel to the bed-stone, by inserting four small wedges of soft wood, two on each side, between the nut and the bottom of its socket. Figs. 3 and 4 represent the iron nuts and the spindle, with the wooden bush by means of which it is held in the centre of the under mill-stone. The dark part in fig. 1 represents the relative position of the teeth of the upper and under stones, the former turning on the latter in the direction indicated by the arrow, and thus continually comminuting the grain, and driving it at the same time from the centre to the circumference, where it escapes.

Having concluded the description of the drawings, interspersed with some particulars immediately connected with them, I have now to observe, with regard to the specimens of stones which I presented to the Society; that those from which the samples Nos. 1 and 2 were taken, are applied to the grinding of the finer kinds of wheat, from which white bread is made; the combination of the hard runner with the soft bed-stone being peculiarly adapted to grind into fine white flour the central parts only of the grain, leaving the bran broad and clean. It is difficult even by coarse sifting to give a brown tinge to bread made from this flour. The samples No. 3 were taken from that kind of stone, in use for grinding the coarse and harder kinds of corn. Their excellence depends upon that quality which enables them to grind almost the whole of the substance exposed to their action; however carefully the flour produced by this style of grinding may be sifted, the

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bread which it produces, although very wholesome and agreeable, is always dark, and in some cases almost black. Provided that these stones possess the essential grinding qualities already specified, they are never deemed too hard; this mode of grinding is essentially economical, for since the quantity of bran which remains after sifting is extremely small, nearly the whole of the grain is converted into flour. HENRY W. REVELEY.

Though from the above particulars stated by Mr. Reveley, it is evident how greatly the system of the Tuscan millers differs from that of the English ones, it may not be improper to state briefly those points of practice which are most at variance in the two modes, and the practical conclusions which may be deduced from them. In England, for fine flour, the hardest French buhrs are employed, and both mill-stones are of the same material; the furrows, or teeth, are in right lines, and the grinding surfaces are flat and parallel to each other; the consequence is, that the grinding is performed partly by grinding, and partly by cutting, so that the bran is more or less torn; and it is found difficult to separate the flour from the bran, without the introduction of what the millers technically call "greys," which are small particles of the darker parts of the corn, ground as fine as the flour itself; and, therefore, not separable by dressing or bolting. The Tuscan method, by combining the hard and soft stones, overcomes this difficulty much more readily; since white flour is produced by means of the same dressing, which, when applied to two hard stones, produces brown flour. The friction of grinding also excites considerable heat, so that the meal comes out sensibly warm to the touch; and it is well known, that flour which has been over heated in grinding,

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or technically speaking, has been *killed*, is incapable of making light bread.

In Tuscany, the upper mill-stone is far from hard, and the lower one is still softer; the teeth or furrows are very shallow, and their form is such as to impel the grain towards the circumference, the distance between the stones is also continually lessening in the same direction, so that the grain appears to be ground wholly by friction without any cutting of the bran, and to this the soft state of the corn, from the previous washing, materially contributes. The consequence of this is, that the bran is separated almost wholly by the first sieve, the flour is pure, and not liable to be overheated.

In another point of view, Mr. Reveley's communication is interesting, as showing, that other stones besides French buhr and others of similar quality, are at least equally fit for the use of the miller. The diallage rock has long been known to exist in Cornwall; it is also to be met with at Girvan, in Scotland; and the hyperstene rock recently discovered by Dr. M'Culloch, in the Isle of Sky, judging from the specimens deposited by him at the Geological Society, appears equally fit for the purpose as the diallage rock. Mr. Reveley, during a late visit in Cornwall, discovered considerable masses of diallage rock of good quality, near the village of St. Kevern, not far from Helford. He has also had the good fortune to discover a quarry of porcellanous lime-stone, equal to the Tuscan, at Coleford, in the forest of Dean, in Gloucestershire. From the information of D. Mushett, esq. the proprietor of the quarry, it appears that this bed is of considerable extent, and that quarries may be opened in it at a very easy distance from water carriage.

As the Tuscan method of dressing mill-stones, appears

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to possess considerable advantages over the common mode practised in this country, even when applied to French buhrs, the following letter from Mr. Reveley is inserted as an appendix to the preceding communication.

King-street, West, Bryanstone-square,
11th November, 1822.

SIR;

I BEG to acquaint you for the information of the Society, that, about four months since, the Tuscan method of dressing millstones has been applied by me to two pair of French buhrs, at the mills belonging to Messrs. Smith and Co. of the White Chapel distillery.

Since that period, these stones have been constantly grinding according to the new plan; and, I am happy to state, much to the satisfaction of the proprietors.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. HENRY W. REVELEY.

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PAPERS

IN

MECHANICS.

N° I.

WROUGHT-IRON GUN-CARRIAGE.

The SILVER VULCAN MEDAL *was this Session given to* MR. R. PERING, *Clerk of the Checque,* ROYAL DOCK YARD, PLYMOUTH, *for a* WROUGHT-IRON GUN-CARRIAGE *for Naval Service. The following Communication on the subject has been received from him, and a Model of the Carriage has been placed in the Repository of the Society.*

SIR; Plymouth Yard, Dec. 21st, 1821.

I REQUEST that you will do me the honour of laying before the Society for the Encouragement of Arts, Manufactures, and Commerce, the accompanying documents, and model of a Wrought-Iron Gun-Carriage, invented by me for the naval service. The advantages which I conceive it to

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possess over the timber carriages at present in use are, first, that it is not liable to splinter when struck by a shot in action, and therefore the people working the gun are less likely to be wounded on such an occurrence taking place. Secondly, the surface of the pieces composing the carriage being less than that of the same when made of wood, nearly in proportion to the specific gravities of the two materials, an iron carriage is less exposed to be struck, and consequently to be crippled, than a wooden one. For the same cause, the gun-deck will be less crowded, and more clear space will be left for fresh air; a circumstance not to be neglected, since it conduces to the health and comfort of the crew.

I am, Sir,

A. Aikin, Esq. &c. &c.

Sec. &c. &c. RICH. PERING.

A REPORT *of Sir* JOHN DUCKWORTH, *Admiral and Commander in Chief of his Majesty's ships and vessels at Plymouth, to the Admiralty, on two* WROUGHT-IRON GUN-CARRIAGES, *invented by* MR. PERING, *to act as substitutes before the Ship comes into Port, in case any of the Wooden Carriages should be disabled in action, as no spare ones are ever taken to Sea.*

Impregnable, Feb. 4th, 1817.

"I HAVE caused two Wrought-Iron Gun-Carriages, invented by Mr. Pering, to be tried in the presence of Commissioner Shield and myself, Captains Ekins, Broughton, Nash, King. The two carriages were put on board the Eridanus, and one of the main-deck guns of that ship was mounted on each of them. The gun was fired eleven times

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without reducing the charge of powder, and eight of those eleven times double-shotted. There were not greater intervals between the firing, than there usually are in action.

"A gun mounted on the ordinary ship carriage was fired occasionally, for the sake of comparison.

"In the course of this experiment, we were not able to perceive any properties in which there was in Mr. Pering's carriage any sort of inferiority; but, on the other hand, it was proved to answer its purpose perfectly; and to possess the advantage of being worked with more facility than the wooden carriage in the proportion of four to five. As an instance of its superiority in this respect, the gun on the wooden carriage was run out, and so was that of the iron. Two men were desired to apply their strength to the former, and endeavour to run it in, but they were not able to move it. The same men were then applied to the latter, and brought it in with ease. The diminished friction in the iron carriage is sufficient to account for the advantage which it thus possesses. The absolute weight of the iron carriage is precisely that of the wooden, viz. six hundred weight and a half.

The qualities in which the iron carriage cannot fail to be superior to the wooden, are, its durability, and its diminished occupation of space. On the value of the former quality it is not necessary to dwell; but in estimating the latter, I would beg to observe to their lordships, that we were forcibly struck with the remarkable clearness of space in the neighbourhood of the port; light and air being admitted where before was a mass of wood; and the deck appearing clear and unincumbered under the gun. It is also to be considered whether the gain of so much additional room for the circulation of air may not be of advantage on a ship's lower deck, when the ports cannot be kept open.

"It also appears to us, that, in action, shot might pass

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between the different parts of the iron carriage, without striking any; whereas such could not be the case in the wooden carriage.

"We are also of opinion, that, as the iron carriage is put together by means of screws, a part of it which should be disabled in action might be easily supplied with a spare piece; whereas, a shot can hardly strike a wooden carriage without rendering it entirely useless.

"The peculiar portability of the iron carriage, fitted as it is for taking to pieces, and occupying so little space, is favourable to the argument of this advantage.

(Signed) J. T. DUCKWORTH.

His Majesty's Dock Yard, Plymouth,
April 24th, 1821.

The Wrought-Iron Gun-Carriages have been at sea since 4th February, 1817, in three different frigates—the Eridanus, captain King; Tigris, captain Henderson; and Spartan, captain Wise; who express themselves much satisfied with the utility of the invention, as appears from the subjoined reports.

A. Aikin, Esq. RICH. PERING.
Sec. &c. &c.

His Majesty's Ship Spartan, Plymouth Sound,
SIR; March 3rd, 1819.

IN obedience to their lordships' order, signified to me by your letter of the 1st instant, I beg to give it as my opinion, that Mr. Pering's Wrought-Iron Gun-Carriages answer very well in every respect. The principal advantages appear to be—1st, the ease of working the gun; which, perhaps, may be stated as five, or even four to six, in comparison with the wooden carriages;—2ndly, (and this is, I think, a most material

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consideration), the much less chance of the carriage being struck by shot;—3rdly, if it should be struck, the still less chance of its being rendered unserviceable;—and, 4thly, the ease with which, in the latter case, it can be replaced by spare ones, as they can be taken to sea in a very small compass; there is also less danger to be apprehended from splinters. The weight I understand to be the same as the wood carriage, but this I have no means of ascertaining. I have fired twenty rounds in twenty-eight minutes; the first seven double-shotted, with a full charge of powder, the next four single-shotted, with a full charge; and the remaining nine single-shotted, with a reduced charge. The gun stood it remarkably well—indeed no gun could answer better. I should recommend the edges of the carriages to be rounded, and a vacancy to be left in the centre of the up and down part of the bed, for the purpose of hooking the train tackle. I have heard it remarked, that side rings for the breeching would be an improvement, but I am very much inclined to be of a different opinion. I am sure a carronade answers better without them; and in the trials I have made upon this occasion, I did not at all find the want of them, for the gun was remarkably quiet (if I may use the expression) the whole time. I think, if the carriages were heated and varnished in the same way we varnish shot for the lockers, it would preserve them far better than paint.

I am, &c.

(Signed) W. F. Wise, *Captain.*

SIR; Tigris, Portsmouth, Jan. 9th, 1821.

In pursuance of your order to me of the ultimo, I proceeded to Plymouth, and received the two iron carriages invented by Mr. Pering, and have since made various trials of them, by constant exercising and repeatedly firing from

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them, with single and double shot and full charge of powder, both when the ship has had considerable motion, and otherwise; during which trials they have answered every expectation I could have formed of them.

I am of opinion, there is much to approve, and nothing to condemn in them. They will, I think, require some trifling alterations, which I have remarked at the bottom of this letter.

I do not take upon myself to say, what might be the effect in a long and severe action, but as far as opinion goes, mine is decidedly favourable to them.

The advantages I speak of are:

1st, That they are not liable to splinter, when struck by shot.

2ndly, That they admit a free circulation of air along the deck.

3rdly, That they are worked with much more ease; saving, I think, two men in ten.

4thly, That any part of them can be conveniently replaced, if injured in action, by spare ones carried in the hold, as they would take up very little room, being taken apart.

5thly, Their durability.

6thly, The mode of housing the gun, I consider a good one, and an improvement.

Perhaps it may be thought necessary to give the whole of the carriage a little more substance, although they appear to stand the trials they have had on board here perfectly well; at all events, it will be proper to take care that none but the best iron is used in making every part of the carriage, and that the workmanship should be good; with that caution, and the little alterations I have pointed out, I should consider them, as far as my judgment goes, very superior to the wooden carriage or any other I have seen.

(Signed) R. HENDERSON.

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Reference to the Engraving of Mr. PERING'*s Wrought-Iron Gun-Carriage*, Plate II.

Fig. 7 is a side view of the carriage and gun, showing the position of the bars for giving a good support; the two side plates, or frames, *l* and *m*, are secured together by four iron rods, *n*, *o*, *p*, and *q*, with screw nuts at each end, and by the two axle-trees *r* and *s*, seen best in the plan fig. 8, and in the front elevation fig. 9 (the same letters showing the same parts in all the figures). The axle-trees have two elbows, or brackets, *t*, *t*, rising from the upper surfaces, to which the side frames are bolted; *v v*, a platform on which the wedge *u* is laid to support the breech. Fig. 10 shows a side view of the platform, separate, with the wedge *u* on it; the square hook *s* fits on the hinder axle-tree, or the small hook *n* will hang on the hindmost rod *n*. Fig. 11 shows a back elevation of the platform, with the hooks *n n*; *w w*, two additional holes into which the hooks *n n* may be screwed, if required: at the front end of the platform is a notch, *o*, fig. 10, to rest on the iron rod *o*, figs. 8, 9; at one side, and at the bottom of the wedge, are two studs or ⊤ hooks *x*, figs. 9 and 10, to slide in the slit of the platform, as seen in fig. 8, by which the wedge may be used either direct or lying on its side, according to the elevation intended to be given to the gun. Fig. 12 shows the joint *y* open to put in or take out the gun; it is fastened by a pin *z*, going into the hole *z*; *e e e e*, fig. 8, four rings by which the carriage is secured.

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Nº II.

LIFE BEACON.

The large SILVER MEDAL *and* TEN GUINEAS, *were this Session presented to Mr.* GEORGE HOLDITCH, *Keeper of the Buoys and Beacons of the Port of Lynn, Norfolk, for his* LIFE BEACON. *The following Communication has been received from Mr. Holditch, and a Model of his Apparatus has beeen placed in the Repository of the Society.*

SIR; Lynn Regis, October, 1821.

ALTHOUGH the establishment of Life Beacons on dangerous sands at sea has been long practised; yet their construction has hitherto been far from perfect, and the expense of erecting them has generally been so considerable as to restrict them to a very few situations. The beacon which is the subject of the present communication, will, I believe, be found to be free, in a great degree, from both these objections: I have, therefore, forwarded a model of it to the Society for the Encouragement of Arts, Manufactures, and Commerce, for their inspection and judgment, in hopes that it may meet with their approbation; and obtain, through the medium of their Transactions, that publicity which may lead to its general adoption. I flatter myself that the lives of many valuable seamen engaged in the laborious and hazardous navi-

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gation of the coasts of this kingdom, may thus be saved to their families, and to the community at large.

GEORGE HOLDITCH,
Buoy and Beaconer.

In the year 1812, the channel leading to and from the port of Lynn, altered about five miles to the westward, which brought the ships, in their course up and down this navigation, near a sand called the Longsand, which is very steep, and about six miles from the nearest shore. This caused a general wish from the shipmasters of the port to have a beacon placed upon this sand, if possible. A petition was accordingly drawn up and presented to the corporation of Lynn, requesting them to bear the expense of the same, which they readily granted.

I immediately set about the work. In the first place, a ten inch square main-piece was driven into the sand twelve feet, with a topmast 36 feet above the level of the sand, and four posts were driven seven feet into the sand for brace-posts; but as soon as there was a heavy sea from the eastward, and a gale of wind, the motion of the braces shook the posts entirely out of the sand. I then secured the braces by heavy stones let into the sand, which held firm until the heavy gale of wind, March the 2nd, 1820, when the whole was washed down.

In July, 1820, I erected another beacon, the model of which accompanies this statement, and which, from its having remained uninjured to the present time, shows, that the imperfections in the construction of the first beacon have been successfully avoided.

The main-piece is a tree of English oak of the best quality, 27 feet long and 12 inches square, shod with iron for four feet, and for five feet above filled close with scuppers (short large headed nails). It was bound round at its upper end

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with three strong iron hoops, to prevent it from splitting, and being thus prepared, was driven about 16 feet into the sand by means of a crane and beetle of 13 cwt.

The topmast is made of a good red wood spar, 37 feet long, and tapering off from 12 inches, its diameter at its base, to 6½ inches, its diameter at the top. It is secured to the main-piece by two stout iron clasps and screw bolts; and to the upper of these clasps are fixed four rings or eyes, to serve as the attachment of as many bars of iron, 1½ inch square and 28 feet long. The lower end of each bar is bolted to a flat block of stone weighing 6 cwt. The stone is buried in the sand, and in a month or two gets so firmly embedded by the tremulous motion impressed by the sea on the shaft, that it would form a secure mooring for a vessel of 100 tons.

A similar iron clasp, with eye bolts, is fixed round the topmast, about eight feet from its summit, and to this are attached four chains, each having a block of stone of 4 cwt. at the other end. These stones, like the others, soon get buried in the sand, so as to keep the chains in a state of tension, and consequently give additional support to the beacon. Just above the upper clasp are three short spars, forming an inverted triangle for the purpose of supporting more firmly the seats which are fixed to the topmast, each piece being terminated by a head of light basket-work, in order to render the beacon more conspicuous. From the seats down to the bottom of the shaft, are cleats, by which, with the assistance of a chain for a man-rope, a sailor or other person may easily ascend to the top of the beacon.

The beacon is erected on the highest part of the Longsand, so that, even in thick weather, persons who may be upon the sand will naturally, as the water rises, be directed to it. Nor is this matter of mere speculation; for three weeks after it

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was erected, two men belonging to his majesty's survey brig, Protector, lost their way in a fog on this very sa and were preserved by retreating before the advancing tide t they arrived at the beacon.

The distance from which it is visible in clear weather wit out a glass is about seven miles, it being seen from Bost and Lynn Knock buoys to the N. E., from Hunstanton cli to the S., and from buoy No. 2 in Lynn well to the W.

The utility of such a beacon on islands of sand whic are covered at high water will, I trust, induce other corpora tions to erect them in suitable places within their jurisdiction

The average expense of such a beacon on a sand like our seven feet above low water mark, would be about £.80.

G. H.

Reference to the Engravings, Plate 9.

Fig. 1 represents the life beacon, consisting of the main-piece, secured by two clasps to the topmast, with the iron bars and large blocks of stone, and the iron chains and smaller blocks by which the beacon is prevented from being forced out of the sand. It also shows the cleats, the man-rope, the seats on the inverted triangle, and the basket-work heads by which it is terminated—the whole being on a scale of one-twelfth of an inch to a foot.

Fig. 2 is a lateral elevation of the upper part of the topmast, showing the seats, the man-rope, and the iron clasp to which the four chains are fixed.

Fig. 3 is a plan of the clasp to which the four iron bars are attached.

Figs. 2 and 3 are on a scale of $\frac{1}{4}$ of an inch to a foot.

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CERTIFICATES.

SIR; Lynn Regis, October, 1821.

THE buoy and beaconer of this port, Mr. George Holditch, having requested my opinion of a life beacon erected by him on a dangerous sand called the Longsand, at the entrance of this channel from the sea, I beg leave to state, that I think it is calculated fully to answer the purpose for which it was intended. It is an invention of his own, and I have no doubt, if the great benefits likely to result from it to mariners were generally known, it would be applied to similar places, as far as practicable.

I have the honour to be, Sir,

A. Aikin, Esq. Your most obedient servant,
Sec. &c. &c. THOMAS ALLEN, *Mayor.*

Lynn, October 26th, 1821.

THIS is to certify, that I have cruized up and down Lynn Well, and have found the beacon on the Longsand, erected by Mr. George Holditch, to be a most useful mark for the above place, and in consequence of shipwreck, would be found particularly serviceable in saving the lives of the people.

JOHN LEAFORD,
Commander of the Erin.

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N° III.

BRIDLE BIT.

The Large SILVER MEDAL *was this Session given to Mr.* C. GOODWIN, *of London Wall, Saddler, for an improved* BRIDLE BIT. *The following Communication was received from the Candidate, and a Bridle-bit of his invention has been placed in the Repository of the Society.*

42, London Wall,
26th March 1822.

SIR;

HEREWITH I send my new-invented bridle-bit, which I will thank you to lay before the Society for the Encouragement of Arts, Manufactures, and Commerce. In the common bridle-bit, billets or loops are fixed upon the cheek, through one of which the end of the rein is passed, and secured by a buckle. Each billet being at a different distance from the center of motion, the leverage of the rein may be adjusted to any required degree, by fixing it to a billet nearer to or farther from the center. Occasions frequently occur on a journey for changing the leverage, which is not very easily effected when the fingers are numbed with cold, nor very safely with a restive horse, since in the process of changing the bearing, the rein must for a time be completely disengaged from the bit,

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and the horse may then start off in a perfectly unmanageable state.

The bit which I have the honour of now submitting to the Society, obviates the possibility of accidents from this cause, there being only one billet moveable on the cheek or lever, and therefore admitting of the bearing being changed in an instant, and without the trouble and hazard of unbuckling the rein. Several of these bits have been sold by me, and have given complete satisfaction, as the annexed certificate will show.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec., &c. &c. CHARLES GOODWIN.

CERTIFICATE.

Charles-street, St. James's,
February 5th 1822.

SIR;

I HAVE tried your new-invented driving bit, and in my opinion, it is admirably calculated to remedy a defect which all other bits have.

The substantial utility of your invention, appears to me, not to consist in the mere power of adapting readily the same bit to different horses, but of affording those who use harness horses, an easy, simple, and above all, a safe mode of altering the reins, when the horse is in a carriage. For many *unmade* horses have peculiarities in their mouths, which renders it necessary to alter the position of the reins on the bit frequently whilst driving them, and to do this in the common bit is not only tedious and often difficult, but attended with a good deal of risk. The horses where such attentions are necessary, are generally high-couraged and impetuous, so that, whilst the rein is unbuckling, the animal is under little control, and

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many instances have occurred, where horses under such circumstances have got loose, and been the cause of serious accidents.

I am, Sir,

Mr. Goodwin,
Bit-Maker.

&c. &c. &c.
JAMES WARDROP.

Reference to the Engraving of Mr. C. Goodwin's Bridle Bit.—PLATE IX.

FIG. 4, shows a perspective view of the bit, *a c a c* the two levers which are cylindrical having (instead of billets or loops) three cylindrical portions, which are divided from each other by the ridges *d* and *e*, *d* and *e*; *b b*, the two billets, with collars to slide up and down the levers; this, however, cannot take place, on account of the ridges, unless when the billet is brought half round, as shown by dotted lines in fig. 5, for on that side, the collars have a groove to pass over the ridges, as shown in fig. 6, where *b* is the billet and its collar, and *c* a section of the lever and ridge; so that instead of having to unbuckle as in the old mode, the billet collar is turned half way round, as in fig. 5, where by dotted lines the collar is shown sliding over the ridge to the required part of the lever, and then turned back again as *b*; but lest by any accident the billet by being shaken half round should slide down of itself, the collar on the outside of each billet is left a little longer at the bottom, near the loop (as *b b b*, figs. 5, and 6), by which it cannot turn round to pass between the ridges, on the outside, and the motion on the inside, is sufficiently guarded by the horse's neck preventing the reins from falling that way.

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N° IV.

IMPROVED BISTOURY.

The Large SILVER MEDAL *was this Session given to Mr.* J. MILLIKIN, 301 *Strand, for an improved* BISTOURY. *The Instrument has been placed in the Repository of the Society.*

THE common bistoury is a slender curved knife, employed by surgeons in opening sinuses, and deep-seated ulcers of particular kinds. But from the form of the instrument, and the local circumstances of the diseased parts, it is hazardous in use, unless a director has been previously introduced to guide the surgeon in the introduction of the bistoury. This however occasions additional suffering to the patient, and requires the presence of an assistant.

Mr. Millikin has combined the director and knife in one instrument, by perforating the handle, and introducing through this a steel plate, of the same width and curvature as the knife, which closely applying itself to this latter, completely prevents it from doing mischief during its introduction, and is withdrawn afterwards without difficulty, by the finger of the operator.

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Fig. 7, plate IX, is a back view; and fig. 8, a side view of the instrument. Fig. 9 is the knife with one of the scales of the handle removed, to show the curved groove in which the lower part of the guard *i k* is deposited, and through which it is withdrawn, by making pressure with the finger on the side of the stud *k*; *g g*, is the blade entirely sheathed by the guard *i* in fig. 7, and partially so in fig. 8; the base of the blade is carried down to the bottom of the handle at *h*; *l* and *m*, fig. 9 show two pieces of iron inserted in the handle, and forming the groove through which the guard passes.

N° V.

SHIP'S COMPASS.

The Large SILVER MEDAL *was this Session given to Mr.* R. PIKE LITTLEWORT, *Lieut. R. N., for an improved* SHIP'S COMPASS, *a Model of which has been placed in the Repository of the Society.*

THE kinds of compasses used on ship-board, are the binnacle or steering compass, the hanging compass, suspended in the cabin to enable the captain to ascertain whether the steersman is attentive to his duty (and hence often called the *tell-tale*), the amplitude compass, and the azimuth compass; this latter, being for the purpose of observing the sun or other heavenly body and thence obtaining the variation of the needle, is only occasionally employed.

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In merchant ships, except those of the largest class, the azimuth compass is generally dispensed with, because this instrument is costly, requires for its use a greater knowledge of navigation, than masters of merchant ships are usually possessed of, and although of great utility, is not an article of absolute indispensable necessity.

The object of Lieut. Littlewort is to render the hanging compass convertible into an azimuth compass, and thus to enable masters of ships to obtain at an easy cost an instrument, the utility of which is unquestioned, and the employment of which will contribute at the same time to the safety of the ship, and to their own improvement in the higher branches of navigation.

Lieut. Littlewort's compass, like the better kinds of common compasses, has two cards, one light and very moveable, for fine weather, and another heavier, for use when the vessel has much motion: this latter lieut. Littlewort has weighted by fixing on its circumference an accurately graduated silver circle; and this it is which is employed when the compass is used for azimuths. The handle by which the compass is suspended to the roof of the cabin, is capable of being inverted and of supporting the compass by sliding in a groove made in a box, which box is capable of motion, on a central pin fixed in the board on which the box stands; moveable sights and a stop are also annexed, which enable it to act when required as an azimuth compass.

The parts will be better understood by reference to the engraving, Plate X., figs. 1, 2, and 3.

Fig. 1, shows the compass, one quarter the real size, with the sights *a* and *b* put on, and fixed up as an azimuth compass, by means of the inverted handle *c c*, in the box *d d*; this box is attached to the board *e e* by a pin in its center, on which it turns; *f* a spring pin, which snaps into a hole at *g*,

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to fix the box when required; *h*, a stop to press against the card and check its vibrations. When it is used as a hanging compass, the arms or frame *c c*, are drawn out of their grooves in the box and turned up, as the dotted lines *i i*, and fixed to the ceiling by a screw *k*, the sights *a* and *b* being then removed the card is seen through the glass bottom. When used as a steering compass, it is put into the box as if packed up, shown in fig. 2, one-eighth of the real size, where the frame *c c* is held by two blocks of wood *b b*, the box being a little longer that way, to receive the frame without a groove; *m*, the place where the sights *a* and *b* are laid in the box.

Fig. 3, shows the board *e e*, with the spring *f*; *n* the center on which the box turns; *p p p*, three studs to give a better bearing for the box *d d*, and to raise it high enough to clear the spring pin *f*, when that spring is pressed down.

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N° VI.

LIFE-BOAT.

The SILVER VULCAN MEDAL *was this Session given to* HENRY GORDON, *Esq., Capt. R. N., for his apparatus for converting a* SHIP'S BOAT, *into a* LIFE-BOAT. *The following Communication has been received from him, and a Model of his invention has been placed in the Repository of the Society.*

SIR; December 21st, 1821.

WITH a view of giving publicity to a plan for buoying up boats of all dimensions, the draught of which is here presented to the Society for the Encouragement of Arts, Manufactures, and Commerce, I have the honour to transmit you the inclosed statement, descriptive of it.

I am, Sir,

&c. &c. &c.

HENRY GORDON.

London, January, 1822.

The late shipwrecks that have happened, and the number of lives which have been lost, owing to the danger attending boats approaching a wreck in a gale of wind, with a high sea on, when they are not previously or expressly built or pre-

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pared for so perilous an enterprise, clearly prove the urgent necessity of adopting some means that may be found adequate to the accomplishment of so important an object.

The writer of this, having paid some attention to the subject, and being thoroughly convinced that it is one of the greatest moment, has visited two ports (Bristol and Rye), where life-boats are kept, and has attentively examined them, and found them both so ponderous and so constructed that he did not approve of either. He objects to the first, because an air-tight locker is one of the buoyant principles; to the other, because she was so very heavy that it must take a great many men to launch; to obviate, therefore, all these difficulties, and to make this kind of boat an appendage to every ship, whether merchant or man of war, he has drawn up the present observations and submitted the accompanying draught, with a view to its being inspected by the Society of Arts, &c.; confident that it will be found to answer, because it has been submitted to experiment by the undersigned, who, on the 6th and 7th of December last, caused a boat at Millbank to be totally submerged, got into her in this situation and floated; the buoyant principle was proportioned only for his weight; but the boat would have as easily floated with fifty persons or more on board, had the buoy been proportionately augmented; thus, proving beyond a doubt, that the theory hereafter explained answers a practical purpose even in the most extreme case.

As simplicity and lightness of weight are the two principles on which the plan, now presented, is founded, it requires little reasoning to show how very essentially such a principle recommends itself to sea-faring purposes, it being an indispensable requisite, that a boat should not be one ounce heavier than is necessary, in order that she may be as portable as possible for hoisting in and out-board, and for being

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sent in the highest sea and the heaviest gale, to take up a drowning man when fallen from the top-sail yard, either by day or night.

The model of the boat in this draught is calculated to row six oars, which, with a coxswain and midshipman = 8 men, triple this, = 24, being the full complement of men such a boat can contain, and then there will be scarcely room for the rowers to pull freely. The buoy is composed of prime Spanish cork, and consists of eight pieces or rows, each piece being a foot longer than that immediately below it. The pieces are connected to each other by strong cord, thus producing a degree of flexibility in the triangle sufficient to allow of its being closely applied to the boat's side, each layer occupying in breadth a streak of the boat. It farther possesses this great advantage, that it is not a fixture to the boat but may be at any time removed, and when the boat is hoisted in-board or out, always can be unshipped, so that the boat is intrinsically as light as ever; neither would it be necessary to carry it on every occasion, yet it would be the safest way never to leave the ship without it.

It measures at the base, one third of the boat's length, and is supported by split canes or bamboo, tied together by strong cord well covered with shoemaker's wax. The pieces composing each individual row, are secured by longitudinal layers of split bamboo or cane, and being thus constructed, a blow that would stave in the boat, would not penetrate the triangle, owing to its elasticity.

Large boats, such as those capable of holding 100 men, instead of being furnished with a single large triangle on each side, should have three of nine feet each in length; by which many advantages will be obtained. First, that the same triangles would serve for boats of different sizes, and hence the expense of the outfit be very materially reduced; second-

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ly, triangles of the above dimensions are more manageable easier put on or taken off and more commodiously stowed away than larger ones. Thus, the launch rowing 24 oars, with 75 men on board, might be fitted in the following manner:—the barge's triangle fixed a-mid-ships, the cutter's on the bow, and the jolly boat's on the quarter, the launch would then be rendered completely buoyant, without any additional expense.

The contrivance possesses at once these advantages: being extremely simple, affording the best security under similar circumstances, being so reasonable in its cost that it is within the reach of every merchant ship to supply herself at a small expense, and is particularly advantageous for the preventive service to approach vessels and visit them when no other boat can; also, to be sent with dispatches to considerable distances in the open sea, on an emergency; provided the crew have sufficient provisions to sustain them, to land at Deal, Yarmouth, Madras, and other beaches, when no other boat can: and to take up a drowning man in a gale of wind at sea when no other boat could live.

HENRY GORDON.

Reference to the Engraving of Capt. HENRY GORDON'S *Life Buoy*, Plate X.

FIG. 4, shows the triangular buoy on a scale of three-eighths of an inch to one foot; fig. 5, an end view: it is formed of pieces of cork one foot long, six inches wide, and about one inch and a quarter thick, laid three thicknesses together and then placed end to end, till of the required length (which is

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here nine feet for the upper streak), and then joined into one streak, by lengths of split cane laid on all four sides and sewed well together; the different streaks are fastened together by four ropes *q q*, *r r*, which are seised together between each streak; when used, the ends *s* are drawn under the keel till the lower streak touches it, and then brought up over the side and fastened to the thwarts, the two upper ends *q* and *r* are also brought over their side and fastened to the thwarts; the other triangle is drawn in like manner on the opposite side of the boat and fastened. Fig. 6 shows the buoy attached to the side of a boat, on a scale of one eighth of an inch to a foot; fig. 7, an end view of a boat, showing both the triangles lying close into the streaks. The triangle here represented, diminishes one foot in each lower streak, the top one being 9 feet, the next 8 feet, and so on, each being 6 inches wide and about 4 inches thick (being made of three layers); two buoys thus made, contain 14⅓ cubic feet of cork, weighing 226 *lbs.*, 10 *oz.*, and displace 944 *lbs.* 8 *oz.*, of sea water, leaving 717 *lbs.* 14 *oz.* of buoyancy, for a boat 28 feet long containing 24 men.

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N° VII.

SYSTEM OF MUSICAL NOTATION FOR THE USE OF THE BLIND.

The Smaller or VULCAN SILVER MEDAL *was this Session presented to Mr.* J. WATSON, *of the Western Exchange, Bond Street, for a* SYSTEM OF MUSICAL NOTATION FOR THE USE OF THE BLIND. *The following Communication has been received from Mr. Watson, and one of his Boards with its accompaniments has been placed in the Repository of the Society.*

Western Exchange, Old Bond Street,
January, 1822.

SIR;

I BEG you will do me the favour to lay before the Society of Arts, &c., my System of Musical Notation for the Blind, which I have found to be advantageous in teaching, being, myself, blind from childhood, and which, I flatter myself, will be approved of by the Society; the following is a description thereof.

I am, Sir,
&c. &c. &c.
JAMES WATSON.

The board containing six staves, is 9 inches broad, 18 long, ½ inch thick, but may be extended to 3, 4, 5, or 6 feet long, and jointed for portability; each of the staves contains two

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raised lines, and a space between the lines, with a space above and below the lines, for ledger lines, as shown by the section fig. 1, plate xi; fig. 2, represents the first portion of the surface of the board, being full of regular rows of holes to receive the pegs; the first stave on the board is treble, the second bass, the third treble, fourth bass, &c., to the bottom of the board, which may be extended to 8 or 10 staves, as may seem best to the user. A crotchet is represented by a plain peg *c*, with a notch in one side, the four different positions of which represent four notes upon the space below the lines in the treble stave, the same four positions of the peg on the first raised line represent the following four notes, and the space, the line, and the space above the lines, each four notes more through the gamut: as shown by the gamut in the plate at the top of fig. 2; and the same in the bass. Fig. 3, represents the different forms of pegs, to express the different notes, crotchet, quaver, &c., each note being placed under its respective peg. A triangular peg with a notch, being used as a signal peg for flats, sharps, time, &c. A semibreve peg *a* is incircled with two projections, and the peg continued above the projections, with a notch in the side; a minim peg *b* has one projection with the peg continued, and a notch; a crotchet *c* is straight with a notch; a quaver *d* has one projection, flat on the top, and a notch; a semiquaver *e* has two projections, flat on the top, and a notch; a demisemiquaver *f* has three projections, with the peg raised above the projections, and a notch; a flat side instead of a notch, to all the foregoing notes, represents them with a dot; an appoggiatura *g* is a peg tapering upwards, with a flat side; a rest *h* is the same, but has a notch instead of a flat side; a bar *i* is flat on both sides, and a double bar *k* is the same, with a notch in the top. The four positions of the triangular peg *l* on the space below the lines, represent

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common $\frac{2}{4}$, $\frac{3}{4}$, and $\frac{6}{8}$ time; the same peg on the first line, posited as in the drawing, expresses sharp, natural, flat, and turn; and on the space between the lines, gives shake, turned shake, beat, and transient shake; on the second line, gives trill, crescendo swells, decrescendo swells, and cord of third.

There are four more positions left on the space above the lines which may be used for more graces. On the bottom of the drawing is represented the first part of "God Save the King," with the corresponding notes in pegs underneath.

The rest note *h*, placed as in the plate on the upper line, indicates the semibreve rest; and semibreve rest with a dot on the middle space, indicates the minim; minim with a dot, the crotchet; and crotchet with a dot on the lower raised line, indicates the quaver; and quaver with a dot, the semiquaver; and semiquaver with a dot, the demisemiquaver.

The staccato peg *m*, is like the quaver peg *d*, except that it has an additional notch in the top.

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N° VIII.

HYDRAULIC APPARATUS.

The Large SILVER MEDAL *of the Society, was this Session presented to Mr.* ROBERT THOM, *of Rothesay Mills, near Glasgow, for a* SELF-ACTING HYDRAULIC APPARATUS, *for regulating the supply of Water to Mills. The following Communication has been received from Mr. Thom, and a Model of the Apparatus is placed in the Repository of the Society.*

Rothesay Cotton Mills,
Nov. 22nd, 1821.

SIR;

ABOUT two weeks ago, I put an improved model of my hydraulic apparatus, on board a smack at Leith, belonging to the London, Leith, Edinburgh, and Glasgow Shipping Company; addressed to the Society of Arts, &c., care of William Vaughan, esq., Mincing-lane, London (freight paid). A drawing and description of the whole, is inclosed in the same box, with the model, as well as directions to the operator, who may exhibit it. In this respect, I have been somewhat particular; because the model exhibits no less than five distinct, and separate operations: that is, each figure in the drawing is a complete apparatus of itself, applicable to a different purpose, or under different circumstances, from any of the others. They are here put very close together, to save

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expense in making a very large model, or a separate model for each; and the apparatus has, therefore, a rather complicated appearance; but when each operation is considered separately, it is very simple; indeed, when viewed on the large scale, the simplicity of the contrivance is the first thing that strikes scientific observers.

The apparatus fig. 1 plate XIV, is more complicated than any of the others, on account of the variety of operations it has to perform; but even this, upon a large scale, will appear simple.

This part of the apparatus, I contrived, in consequence of observing the plan, by which Edinburgh is supplied with water. The defect of the common method for that purpose struck me so forcibly there, that I instantly set to work to find a remedy. As soon as I had finished the model (the same as sent you), I showed it to Dr. Hope, Professor Leslie, and other directors, who expressed themselves much pleased with the invention, and directed their engineer to go to Rothesay, and see the operations on the large scale, and take advantage of them; to me it appears obvious, that its adoption there would not only be of much permanent advantage; but save an outlay of many thousand pounds at present.

The advantages derived from the adoption of these inventions *here* are many. We are relieved from all anxiety and care, respecting the waste of water, and the damage done to banks, and other grounds by its overflow; the exact quantity of water required by the works is always sent down and no more; two steam-engines of thirty-horse power have been superseded: the yearly saving thereby is above six hundred pounds sterling.

It may be proper here to state, that in the Spring of 1819, I sent to the Highland Society of Scotland a model, exhibiting that part of the present apparatus, which is shown in figures

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1 and 2. None of the others were shown; indeed some of them were not then invented, and others were not *proved*.

On the other side, are directions for unpacking the model; and I will be much obliged by some careful and experienced person being appointed to do this, as well as to show the operations; the model has not only cost a good deal of trouble and expense; but will amply repay any one's trouble who has a taste for these matters. When it left this place, it performed every operation with great accuracy.

I had intended being in London about this time myself, but one of our factories being destroyed by fire, about two weeks ago, will prevent me for the present. I will, therefore, feel much obliged by your informing me if the model has come safe to hand, and if you get it to operate satisfactorily.

I am, Sir,

&c. &c. &c.

ROBERT THOM.

Explanation of the Engravings of Mr. THOM'S *Apparatus.*—Plates XII, XIII, XIV.

The Lever Sluice, fig. 1.—Plate XII.

This sluice, when placed on a reservoir that supplies any canal, mill, or other work with water (where the aqueduct between the reservoir and such work is on a level) will always open of its own accord, and let down the quantity of water wanted by such work and no more; that is, when water is wanted it will open, and when not wanted it will shut; so that it not only supersedes the water-man, but saves a great deal of water.

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A B, a tunnel through which the water passes from the dam to

C D, the aqueduct that carries the water to the mills.

E, a float that rises and falls with the water in the aqueduct.

F, an aperture in the mouth of the tunnel.

G, the self-acting sluice that opens and shuts aperture F.

H I, a lever which turns upon fulcrum K, and is connected at one end with sluice G, and at the other with float E.

The sluice G is here represented open, as when the mills are going, but when the sluice is shut that lets the water on the mill wheel, the water in the aqueduct rises and with it float E, which raises the end I and lowers the end H of the lever H I, and shuts sluice G. When the water is again let upon the wheel, the surface of the aqueduct falls, and with it the float, which opens sluice G as before.

Upon the lever H I there is another small lever L M, which turns upon fulcrum M and has the weight N suspended to the other end L. In the ordinary working of the apparatus this lever is quite stationary and produces no effect whatever; but during floods, the aqueduct is swelled by streams that run into it *between the reservoir and the mills*, and when this happens when the mills are not at work, the water, by pressing up one end of the lever when the other cannot get down, would strain or break the apparatus. But, in such cases, the extra pressure raises the small lever which takes all strain off the other parts; that is, the weight M requires more force to lift it than is required to shut the sluice; and therefore will not move till that takes place: but when the extra strain is continued after the sluice is shut, the lever and weight then rise with the float.

The dimensions of the float are nineteen feet square by seven inches deep; the lever is twenty-seven feet long, being

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twice the length between the fulcrum and the sluice, that it is between the fulcrum and the float. The sluice is three feet three inches long and fifteen inches deep; but it requires to be raised only seven inches (when the water in front is three feet high) to pass as much water as gives a power of forty horses to a water wheel, the fall there being twenty feet.

To determine the proper dimensions of the float and relative lengths of the ends of the lever, it was necessary to ascertain how far the sluice required to be raised to pass the quantity of water wanted; and also how far the water in the aqueduct might be raised above the height required to supply the works; the first was found to be seven inches, and the last only four inches. The end of the lever connected with the float was made, therefore, only half the length of the end connected with the sluice; and the float was made of such dimensions that, when sunk half an inch in water, the weight of water thereby displaced was equal to twice the weight required to shut the sluice with an equal lever. When, therefore, the water in the aqueduct rises upon the float half an inch higher than it sinks by its own weight, the sluice begins to move; and by the time the water rises other three and a half inches, the sluice is of course seven inches down, or shut. This apparatus has now been working at Rothesay five years.

The Waster Sluice, fig. 2.—Plate XII.

This sluice, when placed upon any river, canal, reservoir or collection of water, prevents the water within from rising above the height we choose to assign to it; for whenever it rises to that height, the sluice opens and passes the extra water; and whenever that extra water is passed, it shuts again; so that whilst it saves the banks at all times from

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damage by overflow, it never wastes any water we wish to retain.

A B part of a canal, river, stream, or collection of water.

C D high water mark, or the greatest height to which the water is allowed to rise.

E F a sluice, or folding dam, which turns on pivots at F.

G a hollow cylinder, having a small aperture in its bottom, from which proceeds the pipe HI.

K another cylinder, water proof, that moves up and down within the former cylinder.

L a pulley, over which passes a chain attached to the sluice and to the cylinder K.

When the water in the canal or river rises to the line C D, it passes into cylinder G at the small holes M M, and this lessens the weight of cylinder K so much that the pressure of the water in front of sluice E F throws it open. When the water subsides and no longer runs in at the small holes in cylinder G, that cylinder is emptied by the small pipe H I at its bottom, which is always open, and then the weight of cylinder K shuts the sluice as before.

An apparatus of this kind was first erected at Rothesay in 1817. The dimensions of one of these are:

K, two feet diameter and two feet deep, over all: weight 500 *lbs.*

G, five feet ten inches deep and two feet one inch diameter inside.

E F, four feet long and two feet deep, but the cylinders are powerful enough to work the sluice six inches deeper.

This sluice may be made with pivots to turn at the top, bottom, or middle: it may also be placed at the surface or bottom of the water, or any intermediate space, or right below, as suits the particular case; the cylinders may also be placed as shown in fig. 3 without the reservoir; that is, on the outside, or behind the dam or embankment, by having a pipe

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NN to communicate between the upper part of the canal or reservoir and the cylinder. In this case, the chain passes over two pulleys and is attached to an arm projecting from the back of the sluice.

By adopting this principle, a self-acting dam may be raised in any river or stream, up to high-water mark, by which means a considerable reservoir will be obtained, whilst during floods the dam will fold down, and no new ground be overflowed.

In lawns or pleasure grounds through which streams or rivulets flow, these sluices might be applied to advantage; for, by placing one on the bank of each pond, the water within would always be kept at the same height, whether the weather be wet or dry; and, therefore, flowers and shrubs might be planted close to the water's edge, or in it, as best suits their respective habits, and their position with regard to water would always be the same.

The Double Valve Sluice, fig. 4.—Plate XII.

This sluice answers the same end as the lever sluice, but is more applicable in cases where the reservoir is deep and the embankment consequently large. It also answers the purpose of the waster sluice, as it opens and passes the extra water, whenever it rises in the reservoir the least above the height assigned, and of course supersedes a bye-waste.

In making hydraulic experiments, this sluice will also be found of considerable importance, as, by keeping the cistern from which we draw the water for the experiments always exactly at the same height, it will not only save intricate calculations, but make the result on the whole more correct.

A, part of the tunnel through which the water flows from

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the reservoir to BC the aqueduct that conveys the water to the mills. DE a sluice that turns upon pivots at D. FG a hollow cylinder; H another cylinder, water proof, of rather less specific gravity than water, and which moves up and down freely in cylinder FG: a chain, one end of which is fixed to an arm attached to sluice D E and the other to cylinder H, passes over pullies I and K; L a cistern always full of water being supplied by a spring, GM a pipe that communicates between cistern L and cylinder FG; NO the required level of the water in aqueduct BC; P a float which rises and falls with the water in aqueduct BC: attached to this float, is a spindle carrying two valves, which by the descent of the float close the aperture in the lower end of pipe M, and open the communication between M and the cistern L. When the float P, and consequently the attached valves, rise, indicating a sufficiency of water in BC, the water escapes from the cylinder FG, because the lower aperture in M is opened and the upper which communicates immediately with the cistern L is closed; as shown on a larger scale, fig. 1 plate XIII.

The sluice DE, fig. 4 plate XII, is represented shut, cylinder FG empty, cylinder H at the bottom of FG, and the water in the aqueduct at its greatest height. Suppose now, water to be drawn from the aqueduct for any purpose, the float P will fall with the water, and with it the valves. The water now flowing into FG from L will be retained; H will be deprived of its weight and consequently of its action on sluice DE, which will then yield to the pressure of the water in the reservoir and pass the requisite quantity, till the float, P rising to its former level, opens the lower valve and shuts off the communication between L and M; the cylinder FG then empties itself, and the weight H closes the sluice.

In order to make this sluice operate also as a waster sluice,

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a tube is made to communicate between the reservoir and cylinder FG; this tube which must necessarily supply water to FG faster than it can escape by the valve in the lower end of M, enters the reservoir at the height to which we wish to limit the rise of the water, and whenever it rises so as to flow into this tube, the cylinder FG is filled and the sluice DE opens, and passes the extra water so long as the supply continues through the tube to the cylinder FG; when that ceases by the subsiding of the water in the reservoir to its limited height, the sluice DE shuts as before.

The axis of motion of this sluice instead of being placed at the top, may be placed a little above its centre of pressure as shown in fig. 2, plate XIII. In this case, the whole of the operations before described will be reversed; the weight of cylinder H will tend to open the sluice, and the pressure of water in the reservoir to shut it; the rise of the float P, instead of opening the lower aperture of M, will close it and open the communication with the cistern L, as shown in fig. 3 Plate XIII, the consequence will be, that the cylinder H will be deprived of its weight, and the sluice will be closed by the pressure of the water in the reservoir.

In this case, the axis of motion is placed just so far above its centre of pressure as to allow the extra pressure below to overcome the friction, and shut the sluice when cylinder H is floated: this cylinder need only be heavy enough to overcome twice the friction, in order to open the sluice when the water is drawn from cylinder FG; I have found the friction in this case to be less than one-fiftieth of the weight of the column of water pressing upon the sluice; but to guard against contingencies, the machine is made powerful enough to act, although the friction were to become one-tenth, which from the nature of things is more than it can ever be. An apparatus on this

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construction was erected at Rothesay, in 1819, and has been in constant use ever since.

The Single Valve Sluice, fig. 4.—Plate XIII.

The construction of this sluice is nearly the same as the last, only it is applicable in cases where the reservoir is on high grounds above the works requiring the water; and where, of course, the water passes down a declivity.

AB part of the tunnel of a reservoir; CD a sluice that turns upon pivots at C; EF the rivulet that carries the water from the reservoir down to GH, part of a level canal or aqueduct. I is a hollow cylinder; K another cylinder water proof, of rather less specific gravity than water, which moves freely up and down within cylinder I; L a pulley over which passes a chain attached at one end to the sluice and at the other to cylinder K; M a small cistern kept always full of water, either by a small hole below the sluice or by the waste from the sluice; a small pipe communicates between this cistern and the upper part of cylinder I; NO another small pipe, communicating under ground between cylinder I and a valve at the lower end of O, which is closed by the descent of the float P; the float is placed within a small pool of water on the same level as, and communicating with the canal.

The water in the canal is represented as at its greatest height, the valve opened by the float P, the cylinder I empty because the valve at O passes the water faster than it is supplied from the cistern M; the cylinder K is consequently at the bottom of I, and the sluice is closed. When the surface of the water falls in the canal, the float P falls with it, the

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valve at O is closed, the cylinder I is filled, and K floated, the sluice CD opens by the pressure in the reservoir, and supplies water till the canal GH acquires its proper height.

The mode of producing this effect may be varied as in the last instance, by hanging the sluice on pivots a little above the centre of pressure, so that it shall be kept closed by the weight of the water in the reservoir, and opened by the descent of cylinder K; the valve at O will then require to be shut by the ascent of the float P.

It is of no consequence, therefore, in regard to regulating the supply of water, how far the reservoir is from, or how high above the level of the works requiring the water; save that the length of the pipe NO must correspond with the distance, and its strength with the height or pressure of the water; it is necessary, however, that the bore of this pipe should be small, particularly where its length is considerable, in order that the sluice may open or shut in a short time after the valve at O opens or shuts, and at the same time require only a small supply of water for cistern M, as that supply must always flow, whether it be otherwise needed or not. Suppose, therefore, the opening into pipe N O from I to be only half an inch bore, and that the valve at O is shut, it is evident when that pipe is empty, that the sluice CD will not open (or shut if being on pivots placed just above the centre of pressure), till both the pipe N O and cylinder I be filled; and that the smaller the bore of that pipe, the sooner will it be filled. The time, therefore, that sluice CD takes to open (or shut as the case may be) after the valve at O shuts, will always be the same that the pipe N O and cylinder I take to fill; and to make sluice CD take an equal time to shut (or open as the case may be) after the valve at O opens, the aperture of that valve must be such as to take an equal length of time to run off the water, to the bottom of cylinder I (while the water is still flowing from cistern M),

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as the pipe from cistern M takes to fill both cylinder I and pipe NO when the valve at O is shut.

The Chain Sluice.

This apparatus answers exactly the same purpose as the last, but the construction is somewhat different; that difference is described by dotted lines in connexion with the last figure, of which let all the parts be supposed to remain except the pipe from the cistern M, the pipe NO, and the float P. A pipe *m* communicates between cistern M and the upper end of cylinder *n o* from the lower end of which proceeds a pipe *p* connected with the bottom of cylinder I; an aperture in the lower extremity of *n o* is supplied with a valve opening downwards loaded with a weight *q*, and attached to a rod suspended from the end of a lever *r s*, moving on a fulcrum at *t*; a chain passing round two pullies *u* and *v* connects the other end of this lever with a float *w*, of sufficient weight to overcome the loaded valve *q*. To apply this apparatus where the sluice is hung on pivots just above the centre of pressure, no change is required but that of making the valve *q* open upwards. This construction may, perhaps, be adopted with advantage on account of its cheapness, where the reservoir is very near the level canal, but a considerable height above it; as a brass wire one-tenth of an inch diameter will be strong enough for the chain where the distance is short, it having in any case little more to lift than twice its own weight; the former method using the pipe NO instead of the chain, seems better adapted to general purposes.

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The Double Weather Sluice, fig. 1.—Plate XIV.

This apparatus is designed for what are generally called compensation reservoirs, where we are only allowed to retain the surplus water of floods, the rivulet or stream being allowed to flow at all other times the same as if no reservoir were there.

The usual way of doing this, which may be understood by reference to fig. 5 Plate XII. is to cut an aqueduct, AEB round the reservoir C, along which all the water of the stream is carried *past* the reservoir, except during floods, when a part runs over at the bye-wash F into the reservoir.

But before any part is thus allowed to run over, the proprietors below at Z must have all they need; and then the rise that sends part into the reservoir, sends also, more down the aqueduct; this additional part sent down is therefore lost. But the same rains that swell the streams above the reservoir, also swell the streams GHI and K between the reservoir and place below at Z, where the greatest quantity of water may be needed; all this additional water from the streams below, is therefore also lost. By adopting this apparatus all that waste is saved, or retained in the reservoir; so that whilst the proprietors below have, in all ordinary times, the same water as if no reservoir had been made, we retain in the reservoir, during floods, all the water not then needed below.

A Plate 14, a basin of water, behind a reservoir, in which the water is always kept at the same level by the apparatus, fig. 4. plate XII.

B one of a number of sluices of the same kind on that basin.

C a can, open at the top, and having a very small aperture

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bottom, a chain passes over pulley D, having one end fixed to the arm E, attached to sluice B, and the other to can C.

F a weight that keeps the sluice B always shut, when the can C is empty: when that can is full of water it lifts the weight F and opens the sluice.

G H a section of that part of the rivulet immediately before it falls into the reservoir.

I K L a pipe, which communicates between the rivulet at G H and the can C.

When the water in the rivulet G H is so low as only to flow through aperture 1, then, all that water passing down pipe I K L, flows out at M into can C, which being thus filled with water, opens sluice B and passes as much water as the rivulet then brings into the reservoir. But when the rivulet swells so as to flow out at aperture 2, then, the opening at M not being able to pass the whole, the water rises in pipe I K, and passes along pipe N O P, and falling into another can,* opens a second sluice, which, with the first, passes as much water as the rivulet then brings into the reservoir. When the water in the rivulet rises so as to flow out at aperture 3, it rises also in I K, and passing along pipe Q R S, flows out at S into a third can, and opens a third sluice; and these three pass as much water as the rivulet then brings, and which is here supposed to be the greatest quantity wanted at the place Z, fig. 5 Plate XII. Suppose now, the flood should still continue to increase; then the streams and surface water between the reservoir and Z, will increase the rivulet at Z, as well as the higher streams increase it at G H; but there was previously enough of water at Z; when, therefore, the rivulet rises so as to flow out at aperture 4, the water will

* The first can only is shown in the engraving, but the relative situations of the other cans with respect to the pipes P and S, may be easily understood.

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rise also in the vertical tubes NS, PT, RU, MP and S, which are respectively surmounted with wide hollow cylinders T U and V, containing the water-pipe floats W X and Y. The water first rises to float W, which it lifts and thereby shuts valve L; the water in can C then passes out at the small opening in its bottom, and the weight P shuts sluice B, which stops as much water in the reservoir as the streams below have increased. When the water rises in the rivulet so as to flow out at aperture 5, it rises also in the tubes till it lift float X, which shuts another sluice. When the rivulet rises till the water flows out at aperture 6, it raises float Y, and shuts the third or last sluice, the flood being now supposed so great that the streams below the reservoir are sufficient for the supply at Z. When the streams begin to fall, the rivulet at G H will also fall, and when the water ceases to flow into aperture 6, the water falls so far in the tubes as to let down float Y and open one sluice; when it ceases to flow out at aperture 5, the float X falls, and a second sluice opens; when it ceases to flow out at aperture 4, the third sluice opens; which, with the other two, passes all the water that the rivulet is then bringing into the reservoir. Should the rivulet continue to fall so as not to flow out at aperture 3, then the water ceases to flow along Q R, and one sluice shuts; should it fall below aperture 2, the water also ceases to flow along N O, and a second sluice shuts; should the rivulet become quite dry, then the third or last sluice shuts. Any number of sluices may be used as found necessary: and in this way the same quantity of water will always run in the rivulet at Z as if no reservoir had been placed in the rivulet above; except during floods, when all the water not needed at Z, would be retained in that reservoir. Besides the immense quantity of water thus gained during floods, the expense of cutting an aqueduct round the reservoir is also saved,

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nor is any bye-wash necessary, as the main sluice on the reservoir that regulates the height of the water in the basin A, acts also as a waster sluice when necessary. When it is necessary to supply any fixed quantity of water from the reservoir, we have only to make an aperture in the basin of the proper size, and, as the water there stands always at the same height, the supply will always be the same.

The Single Weather Sluice, fig. 2, Plate XIV.

One of the applications of this apparatus is, to give, at all times, an equal supply of water to any work, situated like Z, in the last case, where the reservoir is at a great distance from the work, and where it might be inconvenient or expensive to lay a pipe between them as in fig. 4, plate XIII.

The description of the last figure applies also to this, only when the can C is filled with water, it shuts sluice B C, instead of opening it as in that figure.

In very dry weather, when all the streams between the reservoir and the work are dried up, then it requires all the sluices at the reservoir to be open to give the necessary supply to the works, but when the streams begin to flow a little, one sluice at the reservoir shuts, by the water flowing through aperture 1 into can C; when they increase still further, the water flows out at aperture 2 and along pipe N O, and shuts a second sluice; should they still increase till the water flow out at aperture 3, the third or last sluice shuts, the streams of themselves being now equal to the supply required. As the streams again fall off, the sluices will open, one after another, so as to keep the supply of water at the work always equal.

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It is necessary, in this case, to have a small reservoir near the work to contain the water that flows down at night, or when the work is standing; and then this apparatus will be a complete substitute for the last apparatus, fig. I, plate 14. The purpose, however, for which this apparatus was invented was different. Having occasion to cut an aqueduct round the bases of some hills, to collect water and convey it to a reservoir at a considerable distance, I found that to make the aqueduct so large as to convey all the water during floods would be too expensive; it therefore occurred to me, that if a part of the water could be detained during floods, and brought away gradually afterwards, a much smaller (and of course much less expensive) aqueduct would answer the purpose; I therefore made a small reservoir, at a convenient place, and contrived this sluice to shut during floods and to open as they decreased; and this answered the purpose intended completely, and was the origin of all the weather-sluices.

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N° IX.

HYDRAULIC ORRERY.

The GOLD VULCAN MEDAL *was this Session given to* MR. C. A. BUSBY, *of London-street, Fitzroy-Square, for a* HYDRAULIC ORRERY. *The following Communication has been received from the Candidate on the subject, and a Model of the Apparatus has been placed in the Repository of the Society.*

SIR; 18, London-street, Fitzroy-square, March 1st, 1822.

I TAKE the liberty to trouble you with a small elementary model of an invention of mine, the Hydraulic Orrery, which has met the particular approbation of some of our leading philosophical characters; and which I will trouble you to lay before the Society of which you are secretary.

The larger, and far more perfect machine, is not of a nature to be conveniently moved, or I would have sent it in preference; but, if the members of the Society will do me the favour to inspect it in action at my office, I shall feel myself particularly honoured by the opportunity they will thereby afford me of explaining its motive principles.

I am, Sir,

A. Aikin, Esq. &c. &c.

Sec. &c. &c. C. A. BUSBY.

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Explanation of the Motive Principle of the HYDRAULIC ORRERY.

London, May 1822.

ABOUT three years ago I was engaged, during my stay at New-York, in a course of experiments to determine the resistance opposed to solid bodies of various forms, in their passage through fluids. To perform these in the most simple and effectual manner, I provided a large bason or circular reservoir, and placed therein near the circumference, any floating vessel that happened to be the subject of trial. This vessel was connected by an arbor to a floating centre, held in its place by a small shaft passing through it, and erected perpendicularly from the bottom of the reservoir. The bottom of the floating vessel was pierced, and a syphon which it carried, being soldered into the aperture, rose from it, and extending over the circumference of the reservoir, its other extremity depended in air at a lower level than the surface of the water. This outer leg of the syphon was closed at the bottom; but a minute lateral aperture, resembling a very small finger-hole of a flute, being made, the water spouted through it (when the syphon was charged) in a direction parallel to the vessel, which instantly began to move with accelerated velocity in an opposite course. In a few seconds a maximum was attained, and the future progress exhibited that beautiful, continuous movement which can only find an adequate comparison in the silent gliding of the heavenly spheres. The idea instantaneously impressed me, and has been subsequently embodied, with the most encouraging success, in the novel machine above-mentioned.

At present I have applied the principle, under appropriate modifications, no farther than to the Sun, the Earth, and the

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Moon, whose circuits, obliquities, parallelisms, and rotations, are displayed in apparently spontaneous movements on an area of five feet diameter. To effect these, three floating syphons are so combined in succession, that a quantity of water equal to the discharge of a single stream about one-eighth of an inch diameter, with a head of about seven inches, elicits every action. Each motion, as in nature, is perfectly independent; any one may be checked without impeding another; and when the hydraulic orrery commences its operations, it practically illustrates those incipient and gradually accelerating movements, which may be supposed to have taken place within the mighty system itself, when, as in the beginning, the maximums of the greater motions were probably attained in succession.

This motive principle (founded on Barker's mill, but now first combined with a syphon, and applied to a floating body) is applicable to an extensive variety of experimental and philosophical purposes. It is so truly equable, that by means of it I make the novel and interesting experiment of producing a perfect hydroparabolic mirror fifty-four inches diameter, and thus create any magnifying power *ad libitum*. Whirling tables upon this principle will preserve any particular velocity, during any required period of time, and the motion permits the most minute regulation, either by a variation in the length of the syphon, or of the size of the discharging aperture; or by so fixing a small flexible inclined plane to the syphon itself, and bending it into the stream, as that any proportion of its re-action may be neutralized by its action.

Another mean of obtaining an universal standard of measure is hereby provided independently of the pendulum. Thus a given parabolic speculum, will invariably be formed by any given rotation at any known level and latitude, and the focal distance of any parabola must under those circumstances be

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always a given dimension. A graduated revolving circle will also practically measure such minute portions of time as are beyond the recognition of the most accurate astronomical clocks. The hydraulic orrery when in action lowers the surface of the water upon which it floats, about one inch in an hour; it is effectually stopped by blowing air into the syphons, or by preventing the efflux of water in any other manner.

Construction of the Hydraulic Orrery.

THE Engraving, plate XV, contains the plan and section of the apparatus; the same letters are used to point out the corresponding parts of the figures 1 and 2.

There must first be imagined a circular reservoir 5 feet diameter, of which it is the centre, and B B parts of the circumference; *C C* is a circular gutter (11 inches internal, and 9 inches external diameter) floating concentrically in the reservoir; D is a bar fixed diametrically across the bottom of the inner circle formed by the gutter C C, from the middle of this bar a small shaft E is erected; F F is a cylindrical floating vessel 8½ inches diameter, a tube is soldered into an opening (one inch diameter) in the centre, the top of this tube is closed, except a small hole through which the shaft E passes, and acts as a pivot; a cap covers the central tube and terminates in a rod surmounted by a ball (9 inches diameter) representing the Sun; G is a syphon soldered into an aperture in the floating cylinder F F and balanced by a weight on the opposite side; the other leg of this syphon hangs over into the circular gutter C C, into which it discharges a minute *lateral* stream of water, the re-action of which stream gives a rotatory motion to the vessel F F, and consequently to

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the ball which it carries. The water discharged into the gutter C C, passes away through the tube H, beneath the surface of the great reservoir, and enters the floating cylindrical chamber I I; this chamber is 8 inches diameter, is surrounded by a second cylinder K K 11 inches diameter, but the water of the great reservoir is admitted through large apertures beneath, into the intervening space.

In the centre of the chamber I I, a tube one inch diameter is erected, closed above and below, except small central openings through which the shaft L passes, ultimately bearing a 3 inch ball representing the Earth. In the circular space between the cylinders I I and K K, floats a ring M M, a bar extends diametrically across the upper part of this floating ring, and the shaft L acts as its pivot through a central opening. Upon this ring is erected a small shaft bearing a ¾ inch ball representing the Moon.

On an opposite part of the ring, one leg of a syphon is soldered into an aperture, while the other leg hangs over into the chamber I I, into the lower part of which it discharges a small stream *laterally;* the re-active force of this stream causes the ring to revolve, and, consequently, to carry the ball representing the Moon round that by which the Earth is designated.

The water now brought into the chamber I I, by the two syphons which move the balls representing the Sun and Moon, is carried away by a great syphon O, communicating with it by a short horizontal tube; this water is discharged *laterally* at a lower level from the great syphon into an external gutter P placed to receive it, and its re-active impulse gives motion to the whole apparatus, and causes it to perform a circuit in the great reservoir representing the annual orbits of the Moon and Earth about the Sun.

The parallelism of the Earth's axis is effected, by fixing a

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circular plate (6 inches diameter) to the lower extremity of the rod L, and connecting its circumference by three equal oblique rods 1, 2, 3, with that of another circular plate fixed to the center of the bottom of the reservoir; thus is formed a sort of circular parallel rule, which produces the desired effect; the lateral confinement of the central part of the apparatus being effected by means of the inclined forked brace 4, shaped like a spur, and clasping the fixed plate, itself being fixed to the inner extremity of the tube H upon a hinge incapable of lateral action.

The longer arm of the steel-yard Q (attached to the shaft L and moveable on a vertical joint) sustains the lower extremity of a slender rod connected by an universal joint R with the axis of the 3 inch globe, a small wheel is fixed upon this rod towards the lower end, and the conical rim S S, borne by and revolving with the circular shaft which carries the Moon, acts upon the little wheel by contact with the edge, gives it a rotatory motion, communicated immediately through the universal joint to the globe above, while the shorter arm of the steel-yard is balanced by a weight just sufficient to keep the wheel slightly pressed against the rim.

The obliquity of the Moon's path is imitated, by causing the auxiliary rod sustaining the smallest ball to slide up and down through two projections from the main standard as she revolves; this is effected by making a joint at V and attaching the lower extremity to a revolving crank W, this crank is fixed to the continued axle of a thin vertical wheel X rolling on the horizontal circle Y, which is itself fixed to, and borne by, the shaft supporting the Earth.

The change of the Moon's nodes is performed by making a due variation between the diameter of the vertical wheel and that of the circle upon which it rolls. The four balancers

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(5, 6, 7, 8,) are added, for the purpose of keeping the apparatus steady, by a necessary extension of the floating base.

C. A. Busby.

P.S. I beg to add the following testimonial with which I have been honoured, by some of our leading scientific characters.

CERTIFICATE.

London, January, 1822.

Having seen the Hydraulic Orrery, invented by Mr. C. A. Busby, in action, we feel much pleasure in testifying our decided approval of the apparatus, as exhibiting a novel, ingenious, and elegant application of hydraulic force.

Charles Hutton.
Olinthus Gregory.
Edward Troughton.
P. Kelly.
Timothy Bramah.
Francis Bramah.

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N° X.

IMPROVED HAMMER FOR TURRET CLOCKS.

The sum of TWENTY GUINEAS *was this Session presented to Mr.* W. WYNN, *of Dean Street, Soho, for an* IMPROVED HAMMER FOR TURRET CLOCKS. *The following Communication has been received from Mr.* WYNN, *and a Model of his Invention has been placed in the Repository of the Society.*

Dean Street, Soho,
April 10, 1822.

SIR;

I HEREWITH send you a Model and Description of improvements which I have made in the principles of turret clocks, which I request you will have the goodness to lay before the Society for the Encouragement of Arts, &c. &c.

I am, Sir,
&c. &c. &c.
WILLIAM WYNN.

A. Aikin, Esq.
Sec., &c. &c.

Dean Street, Soho, London.

The great expense attending the manufacture of turret clocks, is occasioned by the magnitude of the machinery which is necessarily employed in raising a ponderous hammer, which shall strike with sufficient force on a large

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bell to produce a sound capable of being heard at a distance from the clock, so as to be useful to the surrounding neighbourhood. It cannot fail to be evident to every one acquainted with the subject, or to any mechanical gentleman who would take the trouble to examine the hammer-work of turret clocks, that a great portion of the force of the percussion of the hammer is lost before it comes in contact with the bell, and, consequently, a great deal of power is exerted in vain, in lifting them. The counter-spring of the hammer (a spring which supports the hammer from resting on the bell) opposes considerably greater resistance to the blow than the actual weight of the hammer, because it has the power of supporting it much above that part of the bell on which it strikes. The friction that takes place between the counter-spring and the hammer is very great, in consequence of the rust which it unavoidably contracts by its necessary exposure to the open air; and I think I should not overrate both these resistances, if I estimated them at equal to twice the weight of the hammer. Having been so fortunate as to obtain the sanction and approbation of the Society of Arts, for a timekeeper which I submitted to them a short time since, I have been encouraged to make a second attempt to obtain their patronage, by presenting them with the model of a hammer for a turret clock, wherein I have succeeded in annihilating both the above resistances, and have made such other improvements in raising the hammer, preserving its pivots from rust, and unlocking the striking part, as I trust will be found of importance to the manufacture of turret clocks, as it regards a reduction in their original expense, by lessening the maintaining power, and consequently, the magnitude of the work, preventing the necessity of subsequent repairs,

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and causing a greater degree of accuracy and certainty of performance.

I have constructed a hammer without a counter-spring, which has the advantage of falling with the whole force of the percussion on the bell without any resistance, and of being caught up at one-fourth of the height from which it fell by the re-action of the blow; consequently, releasing the power of the striking train from the exertion of lifting the hammer equal to that quantity. A hammer on this principle will, therefore, strike a bell with far greater force than one on the usual construction, and it will also oppose but three-fourths of the resistance by its draught on the striking train. On the axis of my hammer is a ratchet, and a click is made to act in it, which has a spring like the hammer-spring of a gun lock, which will force the click both against the ratchet and, by a small change of position, away from it. There is a lever on the ratchet which goes under the click, and which forces the click away from the ratchet when the hammer is raised to strike the blow, and, consequently, gives liberty for the hammer to fall; but, just before it strikes the blow the lever comes in contact with another lever attached to the click, and brings it again in contact with the ratchet, ready to catch the hammer at any height to which it may rebound.

Much friction is occasioned by the pivots of the hammer becoming rusty from their exposure to the atmosphere, which causes a considerable resistance to its draught, and which I have found means to prevent by putting a brass collar over the pivot, so as to form a sort of cup or receptacle for oil, which collar enters freely into a groove in the collet in which the pivot-hole is made. By filling with oil the pivot-hole, which is closed air tight at the end on the outside, the oil will flow over into the cup, where it will be

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retained by the pressure of the atmosphere and by attraction of cohesion, and will completely exclude all moisture from the pivot, which by this means will be prevented from becoming rusty, and will very much reduce the resistance both in the rising and the falling of the hammer.

By the application of a hammer thus constructed, I shall derive a great advantage from the accelerated force of falling bodies, which could not be done where a counter-spring is made use of; for if a hammer had too much fall given it, the counter-spring would not have a sufficient command of it to prevent it from chattering the bell. By the shortness of the draught of the hammers now in use, the accelerated force of the percussion is not taken advantage of; for a hammer of a given weight which falls from a height of eight inches, will fall with four times the force of one from four inches, and cause but twice the resistance; and one falling from twelve inches will fall with nine times the force of the first, and only increase the resistance to three times the quantity. In a hammer constructed on the principle I now produce, there will be no objection whatever to a long draught; on the contrary, it will rebound with more force by falling from a great height than from a lesser one, and thus obtain the advantage of the accelerated force of falling bodies. In the large turret clock at the Royal Military College which I have the management of, there is a hammer that weighs fourteen or sixteen pounds, which does not fall from a greater height than two and a half or three inches. If this hammer were reduced to one third of its present weight, and its perpendicular action increased in a three-fold proportion, the resistance to the train would be the same as it now is, and the addition acquired in the force of its percussion by the accelerated force, would be three times as

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great, without taking into consideration the loss of that resistance which the counter-spring opposes; consequently, the bell would be heard with greater effect in its immediate vicinity, and the utility of the clock would be extended to a far more distant circuit.

I have also found a great resistance in the common mode of lifting the hammer by a hammer tail, both from the great length of space which the pin has to pass along the hammer tail, and the difficulty of making the oil remain on a straight long surface, and that, in an inclined position, subject to continual jerks by the falling of the hammer; so much so, that when I have found the striking part of turret clocks stopping by the cold inclement season, I have made them go by fresh oiling the hammer tail only; a proof that the resistance of that part of the clock has considerable influence on its performance. I have succeeded in lessening this friction, by the application of a compound-toothed sector on the pin wheel of the striking train instead of pins, which acts in a simple-toothed sector instead of a hammer tail, and which reduces the friction in the proportion of twice the versed sines of twelve angles of 3° 45′, and twice the versed sines of 45°, I have made the compound-toothed sector by cutting a wheel of 96 teeth, and filing out six teeth and leaving six, alternately all round the wheel, and the simple-toothed sector of the same radius as the wheel with six teeth, instead of a hammer tail to act in it; so that when the teeth of each branch of the compound-sector have passed through the simple one, it lets it fall in the same way as the pin would let the hammer tail fall. Besides lessening the quantity of friction, the resistance to the train will be equal in all positions of the leverage, and the oil will adhere far more tenaciously to

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teeth than to a plane surface, and it must be the means of preventing the mis-performance of the clock by the inclemency of weather, a thing which often occurs, and which is attended with much inconvenience, particularly where a workman is not at hand to remedy the defect.

The same principle is applicable to the lever of the unlocking detent, to relieve the watch part from a great portion of friction in unlocking the striking part. In the model I now produce, I have made a pinion of twelve with two of its leaves filed out, which represents the axis of the motion wheel which revolves by the power of the watch part once in an hour. This pinion, or rather toothed sector, as it revolves, gathers up a toothed sector with ten teeth of a circle of 144 teeth, whose radius is as twelve to one of that of the pinion; and when that part of the pinion which has lost its teeth comes round towards the axis of the sector it will of course let the lever fall, and the striking part will be released. On the scale which I have made the model, I produce 1·3 inch of motion at the end of the lever; to accomplish this quantity of motion by the spiral curved plate (the best method now in use), the smallest radius of which, is ·5 inch, and the largest one of 1·8 inch, there will be a plane of 7½ inches pass under the lever; but to produce the same quantity with toothed sectors of the proportion of twelve to one, the length of whose legs are 2·7 inches, and ·225 inch, the friction will be only as the versed sines of ten angles of 2° 30′, and the versed sines of ten angles of 30°, which compared with 7½ inches, gives the relative proportion of the friction of the toothed sectors and the spiral curve. Beside so materially reducing the friction, I produce the necessary quantity of motion by a lever, viz., the pinion, at only ·225 inch from the center of motion, instead of its

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acting at from ·5 inch to 1·8 inch from the center, which it would do if the spiral plate were used, which of course lessens the resistance on the watch part in the proportion of those numbers.

The sound produced on a bell by the new-constructed hammer, will be perfectly pleasant, as there will be no possibility of the hammer's chattering on it. All turret clocks are susceptible of being altered, and all or either of the new principles may be applied to any which are now made. In such clocks as are in the habit of stopping in cold weather, the application of the toothed sectors would be the means of preventing that inconvenience, and in those where it might be desirable to extend their utility by increasing the sound of the bell, the application of the new hammer would attain that object in a high degree. By the application of all the new principles in the manufacture of turret clocks, the weight of the hammer will be so lessened, and the friction of drawing it so reduced, that comparatively small machinery will lift them, and that too, with more certainty and accuracy than the large machinery will lift the hammers now in use, because the diminution of the general dimensions of the work will lessen the friction in all its parts, and the expense of the manufacture will be lessened very materially thereby. Any number of hammers may be raised by the toothed sectors.

The principles are applicable to the construction of common house-clocks, and would be a great improvement to them, without materially increasing the expense of their manufacture. In fact, all the levers of the repeating work might be put in motion by the toothed sector, which, as it would reduce the friction, would cause a greater certainty of performance, increase the durability,

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prevent the necessity of repairs and cause the clock to keep time more correctly.

WILLIAM WYNN.

Reference to the Engraving of Mr. WYNN'S *Striking part of a Turret Clock.*—Plate XVI.

Fig. 1 a front view.

Fig. 2 a side view.

a a a the frame containing the hammer work.

b b part of the striking part (the frame plate in fig. 1 being removed).

c the axis of the hammer having a ratchet or toothed segment attached to it.

d a click, which acts in the ratchet.

e (the dotted line) a heart-shaped wheel of brass, fixed on the same axis as the click.

f a spring fixed by a screw at its lower extremity, and terminating at the upper in a roller, which keeps up a constant pressure on the projecting point of the heart-shaped wheel; and thus acts on the click so as to retain it between the teeth of the ratchet, or to hold it up out of contact with them according to the position of the wheel.

g a pin fixed in the ratchet, which comes in contact with the inclined plane of the click as the hammer is drawn up, and throws the click up out of the teeth of the ratchet before the hammer arrives at its greatest elevation; at the same time, the heart-shaped wheel *e* having passed the roller at the head of the spring holds up the ratchet.

h another pin which comes in contact with the tail *i* of the click, just before the hammer in its fall reaches the

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bell driving the heart-shaped wheel back again past the roller; and dropping the click in the ratchet so as to retain the hammer at any height to which it may rebound.

The dotted line *k* indicates the height of the hammer at its greatest elevation; and *l* the position to which it falls when in contact with the bell; and the position *m* of the hammer in the engraving shows the height to which it is thrown by the rebound.

Fig. 1 and 2, *n* the hammer head; the shank of the hammer is unavoidably drawn through the side view, fig. 2, for want of room.

E the compound-toothed sector to be applied to the pin wheel of the striking part; it has eight pins *o o o* in it for the purpose of locking it at each fall of the hammer, which is necessary in the model to make it act properly.

Fig. 1, *p* the simple-toothed sector, in a position ready to act in the compound one when a power is applied.

Fig. 1, *q* a wire which connects the model of the clock with the hammer, and draws it up when in action.

Fig. 1 and 2, *r* the pinion with two of its leaves cut out which represents the axis of the motion wheel.

s the toothed sector, which has a lever or detent fixed to its axis, which represents the lifting and locking detent of a clock, and which is raised by the motion of the pinion *r*, till it has revolved to the place where the teeth are cut out, and then lets it fall, and the striking part becomes released.

Fig. 3 a representation of the axis of the hammer at full size with the brass collars, and apparatus for preserving the pivots from rust.

t t parts of the frame plates.

u u sections of two collets fixed in the frame, with the pivot holes in the center, with a groove turned at *v v*.

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w w two brass collars fixed to the axis of the hammer, which are formed as receptacles for oil, and which are turned to enter the groove *v v* without touching it.

x x two screws which close the pivot holes at the ends to keep them air tight.

The brass collet *u* is drawn out of the frame and off the pivot of the hammer at the bottom of the plate, to represent those objects more clearly.

Dean-street, Soho,
Aug. 17th 1822.

SIR;

When I had the honor to lay my last communication relative to my improved hammer for turret clocks before the Society, I was labouring under indisposition; and it was with some difficulty, I was enabled to produce it in the state I did before the close of the session. I was consequently obliged to make my comparisons of resistance in the best manner I could by estimation, without having the means of making experiments on the subject. Having recently made an experiment on the resistance to the fall of the hammer; I think it necessary to communicate the same to you, especially as the result has turned out far more favourably to my new hammer than I expected; and I hope it will arrive in time to accompany my former paper in your volume about to be published, should the committee of correspondence and papers think proper.

I made the experiment on the hour hammer of the turret-clock, at the Royal Military College, which weighs 12 *lbs.* It has a perpendicular fall of $3\frac{1}{4}$ inches; the axis of the hammer is placed above the crown of the bell, and the head of it, when at rest on the counter spring, forms an angle of about 50° below a horizontal line. I fixed a wire round the center of gravity of the hammer head with a hook below

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it to suspend a weight on. I then lashed a quantity of bricks together, which I found on the roof of the building and suspended them on the wire, and I found that the pressure of ten bricks weighing 66*lbs.* 4*oz.*, did not overcome the resistance of the counter-spring, as I could just discern a space between the bell and the hammer, and the bell would sound when touched. The pressure of 66*lbs.* 4*oz.* on a lever inclined to the horizon in any angle is as the co-sine of that angle to radius, which by estimating the angle of position of the hammer when the experiment was made at 50° below the horizon, will prove the actual resistance of the counter-spring to be equal to the pressure of 42*lbs.* The whole force of percussion of a hammer of 12*lbs.*, falling perpendicularly 3¼ inches does not exceed the pressure of 50*lbs.*, and out of that force the experiment proves that 42*lbs.* is opposed by the resistance of the counter-spring, and only the force of 8*lbs.* remains to put the bell in vibration. The hammer is lifted by an eight day movement with a maintaining power of 5cwt. It is a clock made by one of the first makers, about ten years since, and is I think as fair an object for comparison as could be chosen; but I should feel happy to accompany any gentlemen of the committee, to make similar experiments on any hammers which might be thought proper.

After knowing the result of this experiment, it can be no longer a wonder that we hear such faint tones from most of our church clocks; for although machinery of great magnitude and heavy weights are employed in lifting the hammers, there is comparatively no force produced to put the bell in vibration. It is easy for any one to judge that the bells are not put in vibration, for none of the clocks produce that sound as is produced by ringing the same bell with a rope.

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I beg to suggest also the impracticability of making a clock to go eight days and to strike on a large-sized bell, so as to produce any effect. In fact, according to the present system, it has been found that so great a maintaining power is necessary for that purpose, as will grind the great wheel teeth to dust, before an eight day piece will lift a hammer to put a large bell in vibration; and that will not be found strange to any person acquainted with the laws of mechanics, when it is considered that a hammer of 20*lb.* or 30*lb.* weight has to be lifted 1248 times at once winding up the weight. With the new hammer for which the Society has so liberally rewarded me, this is quite practicable, which will be the means of saving perpetually a great annual expense to the public, by requiring the attendance of a person only weekly, instead of daily to wind it up; and an eight day clock will perform more accurately than a thirty hour one, as it will not be disturbed so frequently by the act of winding.

Even in thirty hour clocks, where the bell is large, it is impossible to produce effect on the present system. I was walking at 150 yards distance from a church recently built, one evening within this month, in an open space, in the most favourable situation I could have placed myself when the clock struck nine; not a carriage moving, and the evening perfectly serene. I listened with the greatest attention to the striking of the clock, and there was one of the blows of the nine, which neither I nor my companion could distinguish. The bell from its sound seems to be a particularly large fine-toned tenor, but the force of the hammer is not sufficient to put it in vibration. If my new hammer was applied to this bell it would increase the sound incalculably.

I will not attempt to give a minute calculation as to the

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increase of force which my new hammer is capable of producing, because the force of percussion of falling bodies as compared with the pressure of gravity, and the resistance occasioned by friction, are neither of them capable of being discovered with mathematical exactness, yet it may be approached to something near the truth. According to the accompanying experiment, it appears that by annihilating the resistance of the counter-spring the force will be increased to six times its present amount, as it will be increased from 8 to 50; which multiplied by three (the increased force produced by extending the perpendicular fall, as stated in my former communication) will produce an increase of eighteen times the force as compared with that of the hammer of the clock at the Royal Military College, and that too with only two-thirds the resistance of the draught of the hammer, the train being relieved from lifting it one-third of its draught. According to this theory, a maintaining power of one-eighteenth the weight when the new hammer is applied, will produce as much effect as is produced on the present system. If the great resistance of friction which takes place by the employment of heavy machinery, pivots of large diameter, and large ropes which are necessarily wanted to suspend the great weights on, be taken into consideration, it will be found to have been hitherto immense; and when it becomes generally known that some of these resistances are annihilated, and others materially reduced, I trust that the new plan will be generally adopted, both in the manufacture of new church or turret clocks and in those which are already in use by exchanging their old hammers for new ones.

I cannot conclude this without informing you that the method of lifting the hammer with the compound-toothed sector is very convenient for the quarter part of clocks, as

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any number of hammers may be lifted with one compound-toothed sector.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. WILLIAM WYNN

N° XI.

REGULATING SCREW FOR THE MAIN-SPRING OF MUSKETS, AND OTHER FIRE ARMS.

The SILVER VULCAN MEDAL *was this Session given to Mr.* EZEKIEL BAKER, *of Whitechapel Road, for his* REGULATING-SCREW FOR THE MAIN-SPRING OF MUSKETS AND OTHER FIRE ARMS. *The following Communication has been received from him, and a Model of the Invention has been placed in the Repository of the Society.*

24, Whitechapel Road,
Feb. 27th, 1822.

SIR;

IN taking leave to request you will lay before the Society the accompanying model of an improvement in gun-locks, I trust the merit of the invention will induce the Society duly to appreciate its advantages; and shall consider the labour and expense as amply compensated

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by their approbation. The following explanation is necessary for clearly comprehending the advantages to be derived from its adoption.

It is well known that the main-spring of all locks loses its strength, either from wear or from the effect of climate, as also that the flints become thick from use—either of which is of itself sufficient to cause the lock to miss fire. This was, perhaps, more particularly exemplified by the volunteer regiments, on field-days, when embodied during the late war, and the fact has been corroborated by many veteran soldiers as having occurred too frequently on the field of battle.

Now, Sir, my invention will remove all this, and may be easily effected by the soldier with the common turn-screw, which it is well known he invariably carries to put in his flint, &c. It consists of a regulating screw-pin, which is placed behind the hammer, through the solid piece of the plate. This pin, when screwed down, acts upon the short side of the main-spring, by forcing which its strength is increased, and more fire is consequently drawn from the hammer; so that, in either of the instances alluded to, fire is produced when it would otherwise fail. On the other hand, when a new flint is introduced, the power of the main-spring may be lessened by turning the screw-pin backwards; by which means the flint is prevented from breaking, as frequently happens when it is put into a lock upon the present construction.

Having alluded to the more important consideration of rendering musket-locks perfect on the field of battle; the same will apply to gentlemen sportsmen, and will prevent the vexation and disappointment that too often occur from locks missing fire, when an experienced shot would otherwise make sure of bagging his game. I have for

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many months experienced its advantages—and have the satisfaction of testimonials from some of the most experienced gamekeepers, whose whole lives have been devoted to the sports of the field. Those of his grace the duke of Bedford, lord Petre, and sir Thomas Lennard would of themselves be sufficient, but I have others from private individuals equally flattering to my improvement.

I should remark, that to all new locks, the invention can be applied *without any additional expense*; but to old locks, in most instances, it will be necessary to have a new main-spring, as the stud which holds it steady on the plate is usually placed on the middle of the short side of the spring; and consequently the regulating screw applied to these may chance to break itself, or break the main-spring: whereas in a new lock I place the stud on the bend of the spring, which enables it to play at pleasure without fear of injuring the one or the other. I also make the hole in the eye of the spring oblong, so as to enable it to play more easily up or down as occasion may require, than the round hole admits.

This invention may be applied with equal effect to the locks of doors, and spring bolts of every description; when, from weakness or any other cause, the springs lose their power; and the great advantage is, that my improvement may be adopted at a very trifling expense.

Having explained the simplicity with which my invention may be applied, I will not take up more of your valuable time; but shall be happy to wait on the Society at their convenience, and furnish every information which may be required for a clearer elucidation than I may be able to convey on paper.

I am, Sir,
&c. &c. &c.,
EZEKIEL BAKER.

A. Aikin, Esq.,
Sec. &c. &c

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P. S. I am well aware, that the hammer springs of saddle pistol and gun locks, have been long since made with a similar provision to the above; but, I believe, its application to the main-springs, where it is of so much more importance, has never been made by any one previous to my doing it.

Reference to the Engraving of Mr. E. BAKER'S *Gun-lock.*—Plate XVII.

Fig. 1 represents the inside of a lock of the usual construction, with the addition of an adjusting-screw *a;* this screw presses against the main-spring *b b*, and when driven forwards greatly increases its power, so that when a flint is getting blunt, the power of the spring may be so increased as to secure its giving fire, and when a new flint is put in, it may be preserved by releasing the main-spring so as to act with no more power than is just requisite to give fire. The hole in the tail of the spring *b* is elongated to slide under the screw head *c* when the adjusting screw *a* is moved.

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N° XII.

CAISSON FOR REPAIRING SHIPS AFLOAT.

The Large SILVER MEDAL *was this Session given to Mr.* W. HOOKEY, *Master Shipwright's Assistant, for a* COFFER FOR REPAIRING SHIPS AFLOAT. *The following Communication on the subject has been received from Mr.* HOOKEY, *and a Model of the Machine is in the Repository of the Society.*

Royal Dock-Yard, Woolwich.
March 21st, 1821.

SIR;

I HAVE long had in contemplation the construction of some simple machine, for the purpose of stopping leaks, and shot holes, and for shifting a few sheets of worn copper from the bottoms of vessels, at the depth of four or five feet under water, without the trouble and expense of docking the vessel for those repairs, and without incurring the difficulties and impediments which I have frequently observed, while in the course of the war my duty called me to attend to the fitting of ships of war at Spithead. Such a machine I have now completed, and a model of it I beg to lay before the Society of Arts; from whom I have already received so many marks of approbation and attention.

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If any repairs become necessary two or three feet under water, the machine may be immediately applied, and if at the depth of four or five feet, it will only be necessary to heel the vessel about two feet, and it becomes applicable at that depth.

I beg only farther to observe, that the machine may be made by any ship's carpenter on board, with any 2 inch or 2½ inch stuff, which is at hand, and consequently at little or no expense, and it may be applied without danger, its simplicity being such that no sailor on board will be at a loss to fix it in its intended situation. Its advantage in a foreign port and open roadsted are obvious, and it will probably in many cases prevent that dangerous and laborious process of heaving down and consequently save a considerable expense.

I conceive it to be unnecessary to enter farther into any written description of this apparatus; I shall therefore, only add, that my object in laying it before the Society is, that it may be made public, and I hope useful to the merchant service and to my country.

I am, Sir,
&c. &c. &c.
WM. HOOKEY.

A. Aikin, Esq.
Sec., &c. &c

CERTIFICATES.

His Majesty's Ship Leven,
Woolwich, November 22nd, 1821.

THESE are to certify, that the machine of Mr. Wm. Hookey's invention, for getting at leaks in a ship's bottom under water, was applied to this ship for the purpose of

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repairing the pipe which lets in water for washing the decks, and succeeded in the completest manner. We are of opinion that it is a most useful invention, and for its simplicity of construction, and facility of application highly deserving of every encouragement.

W. F. W. Owen, *Capt. of H. M. S. Leven.*
W. Cutfield, *Com. of H. M. S. Barracouta.*
Alex. H. Vidal, *Lieut.*
Wm. Mudge, *Lieut.*
Thos. Boteler, *Lieut.*
Wm. Moorley, *Master.*

H. M. S. Sampson, Woolwich,
May 7th, 1821.

I have this day witnessed an experiment, tried on the bottom of H. M. S. Ethalion, by Mr. William Hookey, with a machine of his invention, for stopping leaks in a ship's bottom near the water's edge, and a few feet below it; it answered extremely well, and in my opinion will be found extremely useful in many cases, such as repairing the copper which generally wears first at the water line, getting at the pipes of the cocks of the wash-deck pumps, stopping shot holes, so as to prevent the necessity of careening the ship. In the present trial there was sufficient room for a man to work, and the machine was perfectly dry, although there was a considerable ripple and a strong tide.

Robert Pullman. *Superintending-Master, Woolwich Royal Dock Yard.*

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May 7th, 1821.

We do hereby certify, that the machine constructed by Mr. Wm. Hookey, of his majesty's Dock-yard at Woolwich, for the making good any defects under the water-line, in ships bottoms, such as shifting worn copper, stopping of leaks &c., five or six feet under water, answers the intended purposes extremely well; having seen it applied on a frigate's bottom: and we are decidedly of opinion that it is an invention of great merit, and although very simple in construction will be found of great benefit in the navy, and as such is deserving of every encouragement.

D. Dunn, *Captain, R. N.*
Henry Jones, *Com. R. N.*
Thos. Brown, *Master-Attendant.*

Reference to the Drawing of Mr. W. Hookey's *Coffer for Repairing Ships afloat.*—Plate XVIII.

Fig. 1, *a a a a* part of a ship's side, *b b* the surface of the water shown by dotted lines, *c c* the coffer slung by the ropes *d d d d*, it is sunk by lead weights, and then secured to the ship's side by the twisted ropes and eye-bolts *e e*. The water is then pumped out by the pump *f* and more weights added to resist the upwards pressure of the water, the lateral pressure then forces it very tight against the ship's side, the surface of contact being strengthened and widened by the framing *i i i*, which framing is covered with fearnought *g g* fig. 2, an elastic woollen stuff filled with grease, and surrounded by loose cloth *h h h*, which

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the pressure of the water drives into any inequalities and makes it water tight.

Fig. 2 an inside view of the coffer, showing the elastic surface *g g g*, and cloth *h h h*; *k k k* the wash-boards, shown by dotted lines only in figs. 1 and 3.

Fig. 3 an end view of the coffer *c c*, the surface of contact is curved to fit the ship's side, and may be varied to suit different parts by additional chocks or wedges on the surface.

Fig. 4 a bird's-eye view, the same letters of reference serving for all the figures. Fig. 5 a bird's-eye view of one end of the coffer showing the frame *i* the elastic surface *g* and the cloth *h*, drawn half an inch to 4 foot, the other figures are one quarter of an inch to the foot. Fig. 6, one of the weights.

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N° XIII.

STEAM-ENGINE-BOILER.

The sum of TEN GUINEAS *was this Session given to* THOMAS HALL, *of Glasgow, for a self-acting Apparatus for supplying* STEAM-BOILERS *with water. The following Communication on the subject has been received from the Candidate.*

To The Society for the Encouragement of Arts, &c.,

The Memorial of Thomas Hall, Engineman to the Glasgow Water Company,

SHEWETH:

THAT your memorialist has been entrusted with the management of steam-engines, for a period of nearly 30 years; about half of which time he has been in the above company's employ, having at present under his care three of Boulton and Watt's Engines; one of which is of sixty and the other two twenty-seven horse power each, all of which were fitted up in a complete style, with boilers, feeding and damping apparatus, after the common mode.

Having long been of opinion that the very great consumption of fuel in the working of steam-engines might be much diminished, your memorialist tried many experi-

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ments in order to attain so desirable an object. These he conducted with the utmost care, and at length invented what he considers a decided improvement in the apparatus, and the mode of feeding boilers, by means of which he has effected a saving of fuel, amounting to nearly 25 per cent., as will be seen from the accompanying comparative statement of the actual consumption during the last two weeks of his experiments. Instead of allowing the admission of a constant supply of water into the boiler, suited to the proportion of steam required, your memorialist admits a given quantity at stated times. Convinced from his own experience, that the use of this improved apparatus and new mode of feeding will insure the above saving in all works where the power of steam is employed; and as such a saving to works of great extent, and where the price of fuel is high, must to all interested therein, be a matter of great importance, and a strong inducement to its universal adoption, he will endeavour to describe it as exhibited in the drawings relative thereto, herewith sent. (See Plate XIX.)

Your memorialist made the aforesaid experiments with the 60 horse engine, which was worked about 17 hours daily, at a speed of 12½ strokes a minute. Size of the pump 22 inches, stroke 8 feet; height to which the water is raised in the city 130 feet. This engine is provided with three boilers, 16 feet 9 inches long, 5 feet 6 inches wide, and 6 feet 1 inch deep. Length of furnace bars 3 feet 3 inches; width of furnaces 4 feet 6 inches; declivity 1 foot in 3. This construction, though admirably adapted for the common, is far too powerful for the new mode of working, as it does not require such large fires, on which account it has been necessary to contract them nearly one fourth, and two boilers alone are required to

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furnish the engine with sufficient steam; common height of water in the boiler, 3 feet 6 inches. It is well known that when engines are stopt at night, there is always less or more fire left unconsumed; to which more fuel is generally added, in order to have the furnaces in a proper state for starting in the morning. This strength of fire, it is obvious, must greatly diminish the water in the boiler, so that when the engines come to be set a going, a great deal of water must be let in to make up for the loss sustained by evaporation; at which time also, a great addition of fuel, and much care and attention are requisite. In order to do away all these, your memorialist adopted the plan of running in a given quantity of water at night, above the ordinary height; which he found might be done quite safely in boilers of the above size, to the extent of 18 inches. When he began this mode of feeding, he admitted water by opening the stop-cock, on a branch pipe of 2½ inches, which is connected direct from the main pipe conveying the water to the city, with the top of the feeding or damper-pipes. This pipe was originally so placed for filling the boilers after cleaning, instead of having a cistern in the boiler-house for that purpose. It was by having the use of this pipe that he possessed such ample means of ascertaining correctly, not only the extra height to which water might with safety be admitted into the boiler, but of conducting and bringing to maturity the whole process. Before opening the stop-cock, the valve in the damper-pipe which admits the water was kept open by attaching a weight to the float end of the lever. He then had to stand by the upper guage-cock till the quantity of water before specified was run into the boiler. Although he could, by this means, manage the filling of the boiler quite well himself, yet, being a nice point, it

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required great care and very constant attention. To save this trouble and to obviate any objection which might besides arise to the general adoption of his plan, from the danger of over-filling, or the inconvenience of not introducing a sufficient quantity, the placing of another float in the boiler above that in general use, suggested itself to his mind; and this he found completely to answer the end he proposed. This second float he fixed at the distance of 18 inches from the first, and counterpoised it by a weight under the common one. Its use may be described thus:—*k l*, figs. 1 and 2, Plate XIX, represent the two floats in the boiler *m*, with their respective counterpoises *n o*. By removing the weight *n*, the floats descend, and consequently open the feeding-valve *p*, fig. 2; water being then admitted by turning the stop-cock, the feeding of the boiler goes on, till the water having reached the upper float, it gradually ascends and shuts the feeding-valve, thereby preventing the admission of water beyond the height already stated; and requiring also the instant shutting of the stop-cock, neglecting which, would occasion waste of water, by overflowing the damper-pipes.

Your memorialist was next led to the invention of the small cistern *g*, fig. 1; this he placed on a level with the top of the feeding-pipe, with which it communicates by the conduit-pipe *i i*. On the top of this cistern, is a valve *c*, rendered self-acting by means of a float *k*, suspended from the lever *e*, and counterpoised by the weight *d*. The action of this improved feeding apparatus may be explained as follows: when the engine is stopt for the night, all that is necessary is the removal of the counter-weight *n*, fig. 2, on which the feeding-valve *p* instantly opens, from the descent of the compound float *k l*; the water then flows along the conduit pipe *i i* from the cistern *g*, causes the

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falling of the float *h*, the consequent opening of the valve *c*, and the admission of the water from the main cistern *a* by the pipe *b*. A constant supply is thus kept flowing into the boiler, until by the ascent of the water to the line parallel with float *k*, fig. 1, the feeding-valve is shut; the water, however, continuing to flow into the small cistern *g* raises the float *h*, which shuts off the communication with the pipe *b* by the valve *c*. The feeding of the boilers is thus managed with great simplicity and certainty, the waste of water completely prevented, and attendance at the stop-cock rendered unnecessary. By suspending the lower counter-weight in its place, at the time of setting the engines to work, the farther ingress of water is stopt, this extra 18 inches being found sufficient to work the engine nearly six hours. The running in of a large quantity of water at this time, as well as the care and attention required to be paid to the firing, on the ordinary mode of feeding, are also dispensed with. It has been stated that the quantity of water admitted into the boiler at night, beyond the common height, is 18 inches. This addition, however, from the heat of the furnaces, soon attains a state of ebullition, and a consequent diminution. Here the utility of the self-acting valves in the cistern will be evident; as, whatever waste takes place in the boiler is thereby completely provided for. By the single process of admitting this more than ordinary height of water at night, from 8 to 10 cwt. of fuel is saved. Where engines cannot from the nature of the work be conveniently stopt during the day, the saving from the filling at night only can be obtained; for the weight *n* being an exact counterpoise to the upper float *k*, so soon as the water in the boiler has decreased beyond 18 inches, the under float comes into action the same as if the other had

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not been in use, and feeds the boiler in the common way. But, where engines can at any time be stopt to allow the introducing a given height of water into the boiler, the great advantage of doing so will be apparent;—as, when your memorialist at such times of the day as the service would permit, stopt the engine for repairs, opportunity was again taken to admit water into the boilers by removing, as before, the counter-weight *n*; this occupied from 30 to 40 minutes, at the end of which time, the steam was quite ready to start the engine, provided the necessary repairs were finished. The waste of fuel during this operation was rendered quite trifling, the dampers being confined somewhat below the working point, by means of a hook and chain. A farther saving of nearly 5 cwt. was obtained by this second filling; a third sufficed for the day's work of 17 hours, when the same result was produced, which completed the saving of about a ton of fuel per day, from your memorialist's new mode of feeding, being nearly 25 per cent as already stated. It is not to this decrease in the consumption of fuel alone, that he would solicit attention: but to the farther saving which will arise, from the boilers and furnaces lasting for a much greater length of time, than they do on the common mode of working; as the comparative statement of the quantity of ashes produced from both methods will in part evince. It also simplifies, as well as diminishes manual labour and attention; and, consequently, lessens the risk and probability of accidents arising from the carelessness, or inattention of enginemen or firemen.

The saving of fuel may be carried to a still greater extent, if the main cistern *a* were placed in a convenient situation to receive *the warm water from the engine*, and if steam-engine boilers in general were made sufficiently

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large to allow the admission at night of the requisite quantity of water for the ensuing day's work, particularly where engines cannot be stopt during the day. Even on the plan of feeding with cold water, the saving would be greater were boilers increased in size, the filling at night being the prime object. But that the consumption of fuel must be vastly lessened by feeding with warm water, there can exist no doubt.

It seems only necessary now, that your memorialist explain fig. 3, which shows the floats, and the manner of fixing them to any given height, by the sliding rod attached to the same lever as the common float. The utility of this invention will be strikingly evident, in those works especially, where engines are stopt at meal hours, or any other time; as, whatever quantity of water may be wanted to be run into the boiler, all the fireman has to do, is simply to remove the counter-weight *n*, and fix the float *k* to the height required. The filling will be finished by the time the engines come to be set on, previous to which, the weight *n* must first be suspended in its place. Thus, no working time will be lost, and besides, the fireman may in the meantime be employed with advantage some other way.

THOMAS HALL.

Comparative Statement of the actual Consumption of Fuel, on the Old and New Modes of Working, and the quantity of Ashes produced.

IN the week ending 24th of 11th Month, 1821, the

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engine was worked 103 hours 2 minutes; the quantity of coal used, 18 tons 12 cwt.; ashes, 1 ton 4 cwt.

In the week following, the working hours, were 102 hours 55 minutes; coal consumed, 24 tons 4 cwt.; ashes, 1 ton 16 cwt. The fires kept in the whole time with the above quantity:—

	tons.	*cwt.*		*tons.*	*cwt.*
Last week's consumption on the old mode	24	4	Ashes,	1	16
First week's consumption on the new mode	18	12	Do.	1	4
	5	12		0	12

Equal to about 19 cwt. less per day, and 2 cwt. less ashes.

CERTIFICATE.

Glasgow Water Works Office,
February 14th, 1822.

I, DAVID DENNY, secretary to the company of proprietors of the Glasgow Water Works, hereby attest and confirm the foregoing statement; particularly, in so far as relates to the saving of coals, which has been very considerable.

DAVID DENNY,

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N° XIV.

MAGNETIC GUARD FOR NEEDLE-POINTERS.

The Large GOLD MEDAL, *being the Premium offered, was this Session given to Mr.* J. H. ABRAHAM, *of Sheffield, for a* MAGNETIC GUARD *to protect Persons employed in* POINTING NEEDLES, *and other branches of Dry-grinding. The following Communication has been received from Mr.* ABRAHAM, *and Models of his Apparatus have been placed in the Society's Repository.*

SIR; Sheffield, Aug. 13th, 1821.

HEREWITH please to receive an apparatus which I have constructed to guard the "dry grinders" from the fatal results of their dangerous occupation. The premature death to which they become victims, must excite the energies of every mind not callous to human suffering.

A description of the safety apparatus and testimonials in its favour are herein enclosed.

I have now only to solicit that you will take the earliest opportunity of submitting the whole to the dispassionate and attentive consideration of the Committee of the "Society instituted for the Encouragement of Arts, Manufac-

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ture, and Commerce," and in the interim solicit your acknowledgement of their receipt.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. J. H. ABRAHAM.

SIR; Sheffield, Oct. 6th, 1821.

WHEN I sent you the first model of my newly-invented safety-guard or life-preserver for "dry-grinders" and "needle-pointers," I was not aware that the "Society instituted for the Encouragement of Arts, Manufactures, and Commerce," had offered a premium to any person who could invent an apparatus, which would relieve the "needle-pointers" from the injurious effects, which the steel-pointings and dust produced in their employment have upon their constitutions.

My principal object in sending to you the models, &c., was, that through the medium of the Society, the invention might be more widely diffused among the individuals who suffer so seriously from the effects of "dry-grinding;" by your giving publicity to the discovery, if it should be thought by it sufficiently valuable. The feelings of humanity ought always to prevail over those of a mercenary kind, particularly when we find those who are to be benefited by an invention, and yet not enabled to purchase expensive apparatus, groaning under a disease, not to be relieved by the aid of medicine or medical skill. The simplicity of the apparatus, and the small expense at which every one may procure it, put it within the power of every sufferer to obtain relief. The Society may not, perhaps, be in possession of the information, that thousands of individuals in this country, besides the "needle-pointers" who have been regularly employed in dry-grinding have

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been cut off at the age of from 30 to 40 years. In the town of Sheffield alone, about 100 persons are employed in dry-grinding, and from the best information I can obtain, I find that about 1,000 more are employed part of their time in grinding upon dry grindstones. The articles ground upon dry stones are steel and cast iron forks, awl blades, fire irons, the backs of razors, &c. &c. Upwards of 1,500 persons are employed in Sheffield and the neighbourhood in grinding upon wet and dry grindstones, and I feel confident that the whole may be benefited by using the safety-guard in different forms.

The small model of the safety-guard No. 1, which was coated with needle pointings at Messrs. Cocker's needle manufactory, Hathersage, Derbyshire, is a fine specimen of the power of magnetism. The larger model, No. 1, is coated with metallic particles and grit-dust which is collected by being placed in front of a cast-iron fork-grinder's stone for a quarter of an hour only, in the presence of Wm. Tooke, esq., a vice-president of the Society. I have improved the guard for the mouth, and have sent you one which was coated at Messrs. Cocker's needle manufactory. The steel, &c. attached to it was collected, as will be seen by their testimonial, in two hours, when it was fixed to the mouth of the pointer, when he was at his employment without the safety-guard over his grindstone. When the safety apparatus is properly placed over the grindstone, there is not more metal collected by the mouth-guard in one day, than there would be in a quarter of an hour if the grindstone was without the apparatus.

When I found that the magnetic safety-guard collected nearly the whole of the metallic particles, and that part of the grit-dust, which incrusts them with a thin film from the temperature produced in grinding, I was determined

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to try to collect the remainder of the grit-dust as it rose from the grindstone, and am happy to add that my success has exceeded my expectation. By placing the additional apparatus, which is formed of a frame of wood and a piece of coarse sacking or flannel, closely behind the safety guard, nearly the whole of the metal and dust is secured as it rises from the stone.

Messrs. Cocker's testimonial will, I flatter myself, warrant me in offering myself a candidate for the Society's Gold Medal.

The testimonial, which is signed by several highly respectable gentlemen, will prove to the Society that the advantages to be derived from the use of the safety or life-preserving apparatus by the needle-pointers, will be extended to thousands of suffering individuals; who, after the grinders' asthma begins to afflict them, which generally happens to those regularly employed in dry-grinding when they arrive at the age of 25 or 27 years, linger out a miserable existence till they arrive at the age of 30 or 35 years, beyond the age of 40 years very few dry-grinders are known to live.

Your acknowledging the receipt of the models, &c. will confer an additional favour on,

Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. J. H. Abraham.

SIR;

Having seen your invention of the magnetic safety-guard and dust-retainer, or life-preserving apparatus in operation by grinders upon the dry-stone; we think it due to you to bear testimony to its surprising efficacy. The almost impalpable dust and particles of metal which are

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arrested by the arrangement of magnets and the retainer, is a sight at once alarming and gratifying. To witness the clearness of the atmosphere in a grinder's room of that description when they are in use, and its rapid impregnation with the dust of the metal and stone on their removal, is enough to produce a thorough conviction of the utility of the invention. Indeed, the satisfaction manifested by the men who use them, and their statement with how much more ease to themselves, they can go through their work, and that they feel less oppression and annoyance in a day's labour with them than in a quarter of an hour without, sufficiently evinces that the deleterious matter has been arrested and detained on its fatal progress to the lungs; where, if it once arrive, a complaint is induced which has hitherto baffled the skill of the medical profession. We anticipate incalculable benefit from their general adoption, and can see no reason whatever to doubt that they will most materially prevent that desolating disorder.

Mr. Abraham.

JOHN FEATHER.
JAMES CAM.
J. FAVELL, *Surgeon.*
HALL OVEREND, *Surgeon.*
THOMAS HOLY.
SAMUEL ROBERTS.
OLDALE AND ELLIN.
JOHN STURDALE, *Surgeon.*
ROBERT SORBY.
T. B. HOLY.
WM. PARKER.
BENJAMIN DAMMS.
JOHN EYRE.
JAMES SMITH.

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SIR; Hathersage, Sept. 21st, 1821.

WITH this you will receive your semicircular frame of magnets, which has been placed in operation over a needle-pointer's stone for the space of half an hour, whilst the pointer was pointing No. 14 wire, and which collected considerably more of the steel and dust in that time; but which we found took fire and burnt off when a quantity was collected, to prevent which it will require frequent wiping or brushing off.

The pointer who has most frequently tried your magnets states that with the use of them, and the damp bag which he has suspended over the stone, he has not more dust &c. floating about him in a whole day than he used to have in a quarter of an hour, and which he is confident will be of considerable benefit to him. We, therefore, request you will lose no time in completing our order of the semicircular frames of magnets as being best adapted for the use of the pointers, that we may put all our pointers in the possession of them, for we are convinced they will be found highly beneficial in preserving their health.

The mouth-pieces which we have herewith returned were placed on the upper and nether lip of the pointer for the space of two hours when the semicircular magnets were not in operation, but whilst the bag was suspended over the stone.

We are, Sir,

&c. &c. &c.

Mr. J. H. Abraham. COCKER AND SONS.

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January 30th, 1822.

We the undersigned needle manufacturers at Redditch, in the county of Worcester, do hereby certify, that we have examined and made trial of Mr. J. H. Abraham's apparatus, constructed for the purpose of preventing the ill effects of dry-grinding generally, and are of opinion that the said apparatus, with the exception of passing off the stone-dust, is effectual and may be successfully applied for the use of needle-pointers, whose lives are sacrificed at an early period from twenty-five to forty years of age, in consequence of inhaling the small particles of steel-dust, ground from the point of the needle.

Wm. Bartleet and Sons.
Richard Hemming and Son.
Thos. Williams.
Wm. Roulton and Son.
Wm. Field.

The mark of W. Dunn, *Needle Pointer.* +
The mark of W. Adams, *Needle Pointer.* +

February 26th, 1822.

We the undersigned needle manufacturers at Redditch, in the county of Worcester, do hereby certify, that we have examined, made trial of, and intend to adopt Mr. J. H Abraham's apparatus, constructed for the purpose of preventing the ill-effects of dry-grinding generally, and are of opinion that the said apparatus is effectual and may be successfully applied for the preservation of needle-pointers, whose lives are sacrificed at the early period of twenty-five to forty

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years of age, in consequence of inhaling the small particles of steel and grit-dust produced in the pointing of needles.

Wm. Bartleet and Sons.
Wm. Field.
Thos. Williams.
Richard Hemming and Son.
Wm. Boulton and Son.
Henry Milward.
Benj. Holyoake.
A. Chambers.
John English.

Needle Pointers.

Wm. Hunt.
S. Lock.
Wm. Dunn his mark, +
D. Tandy his mark, +
John Johnson his mark, +
Jos. Thomas his mark, +
T. Chestleston his mark, +
E. Perkis his mark, +
C. Terry his mark, +
W. Clarkson his mark, +
Jon. Johnson his mark, +
G. Terry his mark, +.

We the undersigned having witnessed the life-preserving apparatus of Mr. Abraham in operation, beg leave to

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add our testimony of the beneficial effects of the same toward the needle-pointers.

Rev. J. Clayton, A. B.
Hugh Taylor, *Surgeon.*
John Turner, *Hagley Parsonage.*
F. H. G. Barrs, *Haden Hill.*
A. H. Barrs.
R. Bartleet.
C. Bartleet.
C. Swann.
W. Chambers.

SIR; Bedford-row, April 18th, 1822.

I much regret, that I am prevented by indisposition from attending the Committee of Mechanics this evening, to add my testimony to the efficacy of Mr. Abraham's invention for obviating the deleterious effects of pointing needles, and of dry and wet-grinding in general.

An accidental visit to Sheffield during the last autumn, enabled me to witness the process as to forks and cutlery on an extensive scale.

I saw rooms with nearly twenty persons at work in each, and the contrast between the effect on them and on the atmosphere, while wearing the magnetic guards or without them, was too obvious to escape notice from the most casual observer. In one room the guards as incrusted with particles of steel and iron, after being in use one quarter of an hour were in my presence placed and secured in a box which I have since inspected at the Society's house and which will no doubt have been submitted to the Committee; owing however, to the packing and to the motion of the carriage, many of the finer particles have been dislodged, by which means the singularity of the ap-

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pearance of the guards when fully bearded with the filings has been much diminished.

The workmen employed appeared thoroughly impressed with the beneficial effects of the contrivance, and adopted it with alacrity and gratitude, and I have no hesitation in stating my opinion, that, whether considered as a novel and ingenious application of the mysterious power of the magnet, or with reference to the more important object of alleviating one of the evils incident to some of our manufacturing processes, and thus rendering them consistent with the paramount claims of humanity, this invention ranks as high as any that has ever been submitted to the Society; and I am confident that the committee will duly appreciate the merit of the inventor.

It may be necessary here to remark, that I have had no opportunity of witnessing the effect of the guards in question, in the pointing of needles, which I believe is the immediate subject of our proposed premium; my testimony applies to the grinding of cutlery both wet and dry, a process, as I am informed, scarcely less prejudicial to the workman; and, therefore, this additional application of the protection may probably be considered as entitling Mr. Abraham to some farther token of the Society's approbation, of efforts so meritoriously and successfully made, in promoting its views of practical utility.

As far as I was informed, Mr. Abraham has no ulterior views of profit from his invention; but, on the contrary, has most benevolently aided many poor workmen in procuring the guards at the cheapest rate. He is master of a considerable school at Sheffield, and is otherwise zealously attached to physics as a science, and to many branches of experimental philosophy.

In the promotion of this particular invention, he has

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devoted much time and expended some money in travelling as he was able to find leisure during his few and short vacations, to the several manufacturing districts in the neighbourhoods of Sheffield and of Birmingham.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec., &c. &c. WM. TOOKE.

Reference to the Engraving of Mr. J. H. ABRAHAM'*s apparatus, for preventing the prejudicial effects of dry-grinding.* —Plate XXIII.

Figs. 1 and 2 are a section and a back elevation of a needle-grinder's wheel in which *a* points out the wheel, *b b* the trams on which it is mounted, *c c* cross-rails framed between the trams: *d* the grinder's seat supported on a bracket, *e* an iron guard, which protects the grinder in the event of the stone breaking, and *f* the needles in the act of being ground.

It is proposed to protect the workman from the iron and grit-dust which he produces and inhales, by suspending from the ceiling of the grinding-room a sheet of canvass (painted or not), which shall extend from wall to wall immediately over the axis of the stones. This canvas is to reach to the floor and is to have two vertical cuts in it from the bottom upwards at each wheel, and the slip of canvas thus partially disengaged is to be turned upwards and made to fasten at various heights, either by a hook or button to accommodate the various diameters of the wheels which may be employed; *g g g′ g′* represent the canvass,

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the line at g' g' pointing out a division in it by which the workman gets through to his work, this opening is afterwards secured by buttons or hooks; h is the slip cut out to admit the stone, turned up and buttoned at h' leaving an opening about 1½ inch high over the stone through which the iron and grit-dust is violently impelled by the centrifugal force, as described by the dotted lines i fig. 1. The stream of dust generally maintains a state of brilliant ignition and moves in the direction of the tangent with extreme velocity, for at least twelve inches from the points of the needles; there is therefore no difficulty in conveying by far the larger portion of it into that part of the building seaprated from the workman by the canvass, and the current produced through the aperture by the revolution of the stone, will effectually prevent its return. A few, however, of the lighter particles rise almost perpendicularly from the points of the needles, and these it is proposed to arrest by one or more rows of octagonal magnets suspended nearly over the points of the needles as k k &c.; they may be fixed in a bar l, resting and capable of moving up and and down on two uprights m m supported either on the trams b b or secured to the iron guard e. The canvass besides the apertures already described will require some cutting and adapting to fit as nearly as possible the irregularities of the trams, &c. but all this will be quite obvious and must depend on the particular construction of the mill to which it is applied. A wooden partition might be used with perfect success instead of the canvass, but for the circumstance that the trams and stones are moved forward as the bands which impel them are shortened by rejoining after having broken, and the pliability of the canvass screen renders it peculiarly fitted for adapting itself

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to this change of place. A slight attention to the mode of uniting the bands would make a wooden partition perfectly applicable.

The apparatus described in the engraving has been partially used at Redditch, and as the testimonials show, has been proved to be effectual. The principal difficulties which oppose its general and successful adoption arise from the nature of the buildings in which the work is performed, and from the habits of the men employed in them. In a building about twenty feet long, not so many high, and nine or ten feet wide, from six to nine men work; they are placed on three stages or shelves about six or seven feet wide, occupying one end of the building; the other end contains the machinery. The men sit close to the end wall, and are essentially all in one room, or rather, worse than they would be in one room where all worked on the same floor, for the stages are scarcely far enough apart to allow a man to stand upright, and the dust falls through the joints from one to the other. These grinding-houses are sometimes built in pairs, and in consequence of this a strong side wind which would otherwise be useful, merely blows the dust from the windward to the leeward house. Added to all this, the use of water as a power acting on overshot wheels, occasions the mills to be erected in situations where they are shut up on three sides, by banks nearly as high as their roofs. The result of the whole is, that the air is nearly stagnant, that the immense quantity of iron and grit-dust hourly produced, rolls slowly about the rooms, till the atmosphere has become so fully impregnated that the men are scarcely visible on entering at the door; it then begins to be deposited on the floors and timbers, from which it is again disturbed by the motion of the machinery. On each side of the building, in a line with the

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axles of the wheels, are windows, which it is impossible to close, in the severest weather, and it frequently happens that the water, in which the needles are dipped, will freeze on the hands of the workman. It will be requisite, therefore, for the full success of Mr. Abraham's contrivances, that a greater space be left between the workmen and the wall behind, otherwise the canvass partition confines them in a space so small, that in summer it attains a temperature almost suffocating. It will also be advantageous that the window be divided into two portions, the division corresponding with the canvass partition. The part next the workman should have a glazed casement, to be shut when the weather required it, while the other part might be permanently open.

Although it is true that some of the pointing mills, are not subjected to all the defects of construction and situation which have been enumerated, they are without any exception confined in space, and ill-ventilated. It will be evident therefore, that the complete reformation of the mischief, must depend upon measures to be taken by the larger needle-makers themselves. The benevolent and persevering exertions of Mr. Abraham, must be seconded by them to have any sensible effect. If the early production of a lingering disease, and its consequence a premature death, among a whole class of men, be evils worth remedying, there is no case which calls so loudly for interference, as that of the needle-grinders. Nor is the sacrifice of health and life the only nor perhaps the greatest evil. The workmen are necessarily allured to their pernicious employment by high wages, which as necessarily produce their universal accompaniment, idle and dissolute habits. The excessive earnings of the needle-pointers at Redditch maintain a succession of men, who taint the whole neigh-

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bourhood with profligacy; who with the most perfect consciousness, devote themselves to an early death for the sake of a life of idleness and debauchery, and who acquire such a callous indifference to the fate which they know awaits them, that their apprehensions are said to have been excited, lest Mr. Abraham's inventions should be successful enough to affect their wages.

The case of the dry-grinders at Sheffield and other places, though not so appalling as that of the needle-grinders, is sufficiently bad. They work in rooms which are, generally speaking, much better ventilated, and under circumstances which admit of a very simple mode of preventing the dissipation of the dust in the air. Fig. 3 represents a section of a Sheffield grinder's wheel, of which, fig. 4 is a cross section, and fig. 5 a bird's-eye view. In all these figures, *a* is the wheel which runs in a cast iron trough *b b*; the grinder sits on the block *c*, which lies on the edges of the trough, and holds the article to be ground at *d*, the stream of iron and grit-dust taking the direction *d e*. To retain this dust, a piece of canvass *f f*, formed so as to embrace rather more than a quadrant of the wheel, is suspended from the board *g*, which lies loosely on the trough; the board is notched round the wheel, and over the opening three canes or hazel twigs *h h h* are bent, forming an arch to support a canvass hood. The board *g* is easily lifted from its place for the purpose of wetting the canvass (which must be kept damp), and is as easily returned when that is done. In this manner the whole of the dust is arrested by some part of the canvass, and being retained there by the moisture, requires only to be occasionally shaken out. For further security, an arrangement of magnets (fig. 6), may be fixed in a semicircular frame, and this frame may be placed at the opening into

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the canvass hood, or in any other place which the peculiar circumstances of the case might dictate to the workman. In addition to the radial magnets, other intermediate ones may be fixed on the face of the semicircle, as shown in the side view fig. 7. In all these cases octagonal magnets are recommended in preference to round or square ones, because the particles of iron seem to obey the magnetic influence with more force at the angles of the bar than at its surfaces. The magnets should be forged of steel bars about a quarter of an inch square, the attractive power not appearing to reside above a tenth, or an eighth of an inch within the surface.

For the protection of the workman against the small quantity of dust, which, in spite of every precaution will float about the rooms, and especially during the operation of *raising* the stone when the ordinary apparatus will not apply, Mr. Abraham has constructed a muzzle (see fig. 8), formed of a frame of wood, the upper and lower pieces made circular to fit the lips; on this are fixed two or three thicknesses of crape or muslin, and it is studded with sixteen magnets, which will arrest a considerable portion of the deleterious matter before it can reach the crape; to the upper part of the wooden frame is attached a bent wire, to which crape is fixed for the purpose of protecting the nostrils. The whole is fastened by two strings passing round the head and tying behind. It has also been found that a semicircular frame similar to figs. 6 and 7, but without feet, having the magnets only on the face, may be worn round the neck with considerable advantage.

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N° XV.

DETACHED ESCAPEMENT.

The Large SILVER MEDAL *was this Session given to Mr.* GEORGE SAVAGE, *of St. James's Street, Clerkenwell, for his* DETACHED ESCAPEMENT. *The following Communication has been received from the Candidate on the subject, and a Model of his Invention has been placed in the Repository of the Society.*

SIR; 5, St. James's Street, Clerkenwell.

IT is generally admitted by scientific practitioners in the watch trade, to be an important *desideratum*, to have an escapement produced that shall at once combine simplicity of principle, precision of performance, and cheapness of execution. An object that has long and much occupied my attention, and which, I persuade myself, is accomplished in the improved anchor or detached escapement herewith sent. It combines the most essential properties of the anchor, duplex, and detached. It is free from that extreme delicacy, which renders the two latter liable to be injured in the hands even of good practical workmen, and the watches may, in this respect, be repaired by persons understanding merely the first prin-

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ciples of the art; it is, therefore, the best article of the kind for exportation.

From the friction being less, it requires a comparative small portion of power to keep it in motion, nor will it, as the other escapements, remain at rest, and is therefore less liable to stop, and it will perform without oil, except in the pivot-holes, which properties taken in conjunction with its comparative cheapness of execution, will entitle it to pre-eminence, among similar productions of art.

Under such impressions, and from the encouragements given by the Society of Arts, so laudably and beneficially instituted, to stimulate, patronize, and promulgate useful discoveries, I most humbly and respectfully submit the escapement for inspection, hoping thereby, to realise that best reward for inventive exertion, the approval of gentlemen entertaining enlightened views of the useful arts, and united for the purpose of giving them extensive effect.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. GEORGE SAVAGE.

Reference to the Engraving of Mr. GEORGE SAVAGE'S *Improved Anchor or Detached Escapement.*—Plate XXII.

Fig. 1st, *a b* the locking detent; *c d* the lever fixed on the same axis with the detent; *c* the fork of the lever; *e* the unlocking pallet, fixed on the balance staff; *f* the impulse pallet, fixed on the balance staff; *h* the escape wheel; *i* a roller fixed on the balance staff; *k*, a small cock or safety point, fastened to the under side of the lever at the fork end: *l m* banking pins.

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Fig. 1 represents the wheel locked by the detent *a*, the unlocking pallet *e* having just entered the fork *c*, is beginning to unlock the wheel; that prong that is now receiving the unlock-pallet *e* stands in a right line with the center of the detent *a b*, and the balance staff: as the unlocking pallet *e* leads the lever towards the banking pin *l*, the impulse pallet *f* advances, and the detent *a* recedes from the tooth, and when the unlocking pallet *e* has led the lever up to the banking pin *l*, which is about 4°, the detent *a* will be disengaged from the tooth that locks upon it, and the impulse pallet *f* will have advanced a little past the point of intersection to receive its impulse from the escape wheel.

Fig. 2 represents the unlocking-pallet *e* just parting from the fork *c*, having lead the lever up to the banking pin *l*, the detent *a* is disengaged from the tooth of the wheel, and the impulse pallet *f* which has arrived past the point of intersection, now receives its impulse from the escape wheel, which continues through 44° of its vibration, and the detent *b* has already advanced to lock the wheel when the impulse is completed.

Fig. 3 represents the tooth of the wheel, having discharged the impulse pallet *f*, which has led the balance 44°, and the wheel is now locked by the detent *b*; the balance continues its vibration through 225° from the commencement of its impulse; having arrived to the extent of its vibration, the power of the pendulum-spring brings it back, and the unlocking pallet *e* enters the fork and leads the lever up to the banking pin *m*, which unlocks the wheel from the detent *b* with a little drop, as is represented in fig. 1, and the vibrations are repeated. *k*, a small cock or safety point, fixed to the under side of the lever at the fork end, this cock effectually prevents the fork from being removed, during the vibration of the balance, this cock is made to pass a hollow in the roller *i*, and

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can only pass when the unlocking pallet *e* is leading the lever from one banking pin to another.

Fig. 4 is an elevation (the same letters of reference serving for all the figures), *a b* the locking detent; *c d* the lever; *e* the unlocking pallet; *f* the impulse pallet; *h* the escape-wheel; *i* the roller with a hollow or notch to receive the safety point; *k* the safety point or cock fastened to the underside of the lever at the fork end.

In these four figures the pallet *e* and roller *i*, are represented as united in one piece; fig. 5 represents them as separate.

Fig. 6 a bird's-eye view of the same.

Fig. 7 represents the lever *c d* and unlocking pallet *e*, together; the dotted lines show the limits of their action.

N° XVI.

RAT TRAP.

The Sum of FIVE GUINEAS *was this Session given to Mr.* S. BOWLER, 34, *Uxbridge Street, Newington Causeway, for a* RAT TRAP, *which has been placed in the Repository of the Society.*

THE principal novelty in this trap is, that it may be set to go off, so as to take one or more rats up to twelve at a time, according as may be judged proper. The trap is

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discharged by pressure on the platform where the bait is placed, and the wire or catch, the release of which allows the springs to close the doors, has several notches of different degrees of obliquity; and, therefore, requiring a greater or less weight to discharge the trap according as the ring is placed on a notch less or more oblique.

The floor of the trap should be strewed with flour or meal, and the best bait is a red-herring stitched through and through repeatedly with strong thread which prevents the rats from tearing it in pieces, and by entangling their teeth causes them to crowd close to each other on the bridge or platform, till their accumulated weight is sufficient to discharge the spring.

It appears from the testimony of Mr. Ford, a baker, that he had repeatedly taken from eight to twelve rats at a time in this trap.

Reference to the Drawing of Mr. S. BOWLER'S *Rat Trap.* Plate XVII.

Fig. 2 is an end view of the trap set, forming a thoroughfare, both ends being alike; fig. 3 is a side view of the trap also set; fig. 4 is a section with the flap *g* set, and flap *f* down; fig. 5 is a bird's-eye view with flap *f* set and *g* down: the same letters of reference serving for all the figures. *d d*, *e e* the sides of the trap, *f* and *g* the two flaps; each flap has a wire button *h* and *i*, by which it is suspended on the bent ends of the wires *k k* and *l l*; the other end of the wire *k* is bent as shown in fig. 3 to go under, and be kept down by the longer wire *l*, and this wire is detained by the ring or catch *m* which is the end of a

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wire that crosses the middle of the trap, and supports the platform only in the middle by means of a piece of bent iron *n* fixed under the half *o*, the other half *p* is supported by *o*, a plate of iron *q* being nailed on *p* to cover the gap between them and to rest on the half *o*; figs. 6 and 7 show the joint at the other end of the wire or catch *m* with the piece *n* that supports the platform resting on it. The flaps are urged downwards by spiral springs *r s r s* the end *r* being fastened to the flap, the end *s* resting on the next wire, the bait is put on a hook *t* fixed to the middle of the side *d d* shown in fig. 5 under the wires.

Now when the rats come in and stand on the two boards *o* and *p* (which are jointed at *v v* by two staples to each, and wires crossing the bottom of the trap), their weight presses down the wire or catch *m* so as to slip off the wire *l* and let it go, it then flies up as shown by dotted lines in fig. 2, and the wire *k* also flies up with it; their bent ends (which before supported the flaps) are then turned downwards and let go the flaps as shown at *f*, and at the dotted lines *g*, fig. 4, and the rats are thus inclosed. That their tails may not be pinched, there are stops *u u*, figs. 2 and 4, to receive the flaps before they can touch the bottom. Two pins are also fixed at *w* to guard and guide the wire *l*; *x x* are two wire buttons to keep the wires *k* and *l* down while baiting and setting; when the trap is set they are turned out of the way, as figs. 3 and 5; *y y* are two tumblers which fall on the flaps, and prevent them from being raised again by the rats, pins are placed adjacent to the buttons *h* and *i* so as to make them stick when in the right position for setting, *z z* are two flap entrances one at each end to admit more rats after the main flaps have been discharged: one of them has a chain and ring by which it may be raised, and in fig. 2, there is a pin hanging by a

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chain which may be run through a hole in the side of the trap to fix up the flap, while driving the rats into a receiving cage, that they may never be killed or hurt in the trap, as the smell of their blood would deter others from entering. In order to set the trap to catch one or more rats, the end of the wire *l* is notched, fig. 8 shows the notched end larger, the bottom step is straight, and will go off with the weight of one rat, the next is a little sloping back, the third a little more, and the fifth most of all, so as to require the weight of 8 or 10 or more rats to discharge it, estimating the weight of a full grown rat at $\frac{1}{2}$ *lb*. The edges of the two small entrances *z z*, the ends of the flaps *fg*, and of the platform *o p* are sheathed with thin iron to preserve them from being injured by the rats; a pin shown by a dotted circle *a* fig. 4 projects from the side *d* to prevent the platforms from rising high enough to get out of their place, the figures are one-sixth the real size.

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N° XVII.

INSTRUMENT FOR MARKING A SHIP'S PLACE ON A CHART.

The Large SILVER MEDAL *was this Session given to Mr.* EUSTACE WIGZELL, 10, *New Milman-street, for an* INSTRUMENT FOR MARKING A SHIP'S PLACE ON A CHART. *A Model of the Instrument has been placed in the Repository of the Society.*

THE ordinary way of marking off on a chart, the course of a ship is, to prepare a reticulated blank chart, that is, one divided into quadrilateral figures by the intersection of the parallels of latitude and longitude drawn for every 10°; and then, by means of a parallel rule and compasses to mark within the proper square, the place of the ship according to the latitude and longitude obtained by observation. In doing this, however, the errors arising from deflections of the parallel rule and inaccuracy of the compasses are often considerable; and, in order to avoid these, the candidate has invented the instrument, a description of which follows. The instrument figured was made expressly for Horsburgh's East India Charts, Nos. 5 and 6, but the principle may be adapted to any other chart.

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Fig. 1, Plate XX, shows the instrument as applied to a chart, and consisting of two pieces or arms placed at right angles to each other. The vertical piece marked chart No. 5, is a latitudinal scale graduated for Horsburgh's East India Chart of that number, the cross piece is a longitudinal scale for the same chart. The instrument is made of box wood except the slide *a* and that part of the cross scale which clips the vertical one. The slide traverses in the groove made in the vertical piece, and from its considerable length scarcely admits of any play or shake in the cross piece; the clip, by firmly embracing the vertical piece, adds still farther to the precision of the instrument.

Fig. 2 shows the latitudinal scale separate, but presenting the face opposite to that in fig. 1, and graduated for chart No. 6. It has a groove in each side as shown by the section fig. 3, to receive the slide *a a*. Fig. 4 is an edge view showing the graduation on that surface, and the manner in which the brass clip embraces the vertical piece.

To use the instrument, fix the longitudinal scale so as to allow the upper part of the brass to cut the latitude given; then place the instrument flat on the chart—the base line of the perpendicular scale to be on the nearest parallel of latitude lower than the spot to be marked, and the inside edge of the same scale, on the meridian of longitude to the westward of the required point. The extreme line of the longitudinal scale will then intersect the next meridian. The given point of longitude may be marked with a pencil, and it will, of course, show the exact position of the ship on the chart.

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N° XVIII.

SCALE FOR CORRECTION OF TEMPERATURE AS APPLIED TO THE HYDROMETER.

The GOLD VULCAN MEDAL *was this Session presented to Mr.* ALFRED AINGER, *for his* SCALE FOR THE CORRECTION OF TEMPERATURE, AS APPLIED TO THE HYDROMETER. *The following Communication has been received from Mr.* AINGER *on the subject.*

THIS scale is formed generally on the principle of that rewarded two years since by the Society, and published in the 38th volume of its Transactions.

The stem of the hydrometer is supposed to be graduated so as to give accurately the strength of mixtures of alcohol and water at some one temperature, which may conveniently be 55° of Fahrenheit. The particular construction of the hydrometer is not material; the divisions may be either the natural series shewing at once the strength, or they may be arbitrary, like those in Sykes's; if the former, the stem may be made long enough to contain the whole range, or weights may be used, and different portions of the range engraved on different faces of the stem. In either case a counterpart of the divisions in the stem must be engraved at greater length on a wooden, ivory, or metal scale; and it is proposed, in order to avoid the multiplication of instruments, that for this purpose

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the back of the thermometer be used, which, as the observation is required to be made immediately after the temperature has been taken, is conveniently in the hand for the purpose.

The middle range of divisions in fig. 2, plate 24, may be supposed to represent the counterpart of those on the stem of the hydrometer; by the side of these are to be engraved others, corresponding with 1 degree of Fahrenheit, and embracing so much of the middle scale as comprises the amount of affection produced by a variation of 1° in the temperature. On one side (the left) of the middle scale are to be engraved the corrections for variations in temperature below the mean (55°) and on the other side (the right) those for variations above the mean. The former of these is called the *ascending*, and the latter the *descending*, *correcting* scale; the middle line of divisions may for sake of distinction be called the *indicating* scale.

The correcting scales are to be used in the following manner; for every degree that the temperature of the liquor under examination falls short of 55° or the mean, one division is to be counted upwards on the ascending scale, from the point which the hydrometer gave as its strength, but which would be evidently too low, because the specific gravity of the fluid would have been increased by its defect of heat. In the same manner one division is to be counted downwards on the descending scale for every degree of heat above 55°. Thus, in the first instance, if the thermometer stood at 48°, which is 7° below the mean, seven divisions must be counted upwards on the ascending scale; and in the second, if the thermometer stood at 60°, which is 5° above the mean, five divisions must be counted downwards on the descending scale. To facilitate the observations as to the excess or defect of temperature, the thermometer is to have an additional

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graduation, as shown in figure 1, which commencing from 55° as its zero, is numbered above and below that point for about 25°, which includes the extreme limits of temperature, under which liquors are liable to be examined. The part above the zero may be marked by the word "DESCENDING," that below by the word "ASCENDING," which will refer to the correcting scale to be used.

The necessity for two correcting scales, arises from the circumstance, that an error amounting in some cases to one tenth per cent would be incurred by using the same scale to make the correction both for excess and defect of temperature; the two scales also facilitate the correction by substituting the operation of addition for the more difficult one of subtraction, which with one scale only must be used for correcting the effect of high temperature.

To construct the scale, it is necessary to have a set of experiments, showing the specific gravities of a series of mixtures of alcohol and water at various temperatures, the proportions of those mixtures given in terms, both of their weights and bulks, and it will be necessary to have the quantity of condensation occasioned in the several mixtures by the chemical union of the two fluids. All these particulars are given in the extensive tables, published by Mr. Gilpin, in the Philosophical Transactions for 1794. The perfect accuracy of those tables is not essential to the present purpose which is merely to point out how the results of similar experiments may be applied to the construction of scales, such as have been alluded to. It must however be recollected, that the language in which the strength of spirits is usually expressed, differs from all the terms in the tables above-mentioned, depending, as will be seen, neither on the specific gravity of the mixture, nor the relative proportions of the constituent fluids. The indications of the hydrometer are

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given in terms evidently derived from the application of the instrument to purposes of revenue, and which are founded on the arbitrary assumption of a particular mixture of alcohol and water, to which, as a standard, all other combinations are referred. This standard is called "Proof," and the difference between it and any mixture of alcohol and water is described by saying that the latter is a certain quantity per cent above or below "proof;" meaning, in the first case for instance, that one hundred gallons of a mixture which is *ten per cent above proof*, may be reduced by the addition of water to one hundred and ten gallons of *proof;* and in the second, that one hundred gallons of a mixture which is *ten per cent below proof* contains alcohol enough for only ninety gallons of *proof.* It may here be remarked, that for the reduction to proof of one hundred gallons of spirit ten per cent above proof, it is not enough to add just ten gallons of water, because the chemical union of the two fluids would condense the two quantities into something less than one hundred and ten gallons, perhaps into one hundred and nine and a half; rather more therefore than ten and a half gallons of water must be added, and precisely the same remark will apply to the supposed abstraction of water from a mixture which is below proof.

For the reason before stated, that none of the expressions in Gilpin's Tables are given in the same terms as those of the hydrometer, a method of reducing the one to the other must be obtained. By a late act of parliament it is determined, that proof spirit at 51° shall weigh twelve thirteenths of an equal bulk of distilled water; if, then, we divide 12 by 13, we obtain ·92308 for the specific gravity of proof spirit at 51°, as compared with water of the same temperature; but as water is supposed to be at 60° when it is made the standard of comparison with other specific gravities, we must multiply ·92308 by 1·00063 the specific gravity of water at 51°, which

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gives ·92366 for the specific gravity of proof spirit at 51° as compared with water at 60°.

Now, by referring to Gilpin's Tables, under the head "51°" it appears that a mixture of 100 parts by weight of alcohol* and 80·85 of water, has the specific gravity (·92366) of proof spirit; the same quantities by measure or bulk are 100 of alcohol, and 67·00 of water, which will be concentrated or condensed, 4·63 by mixture, leaving 162·37 as the quantity of proof spirit at 51° resulting from 100 parts of alcohol at the same temperature. But as 55° is the zero of our thermometer scale, the constituents of proof spirit must be obtained at that temperature by transferring the observations already made to the Table, headed "55°;" for although 100 and 80·85 will remain at every temperature, the invariable proportion *by weight* of alcohol and water in proof spirit, yet the *bulks* of those proportions will vary with every loss or accession of heat, as an instance of which, the *bulks* which at 55°, correspond to the *weights* 100, and 80·85 are 100 and 66·87, these will be concentrated 4·57 by mixture, giving 162·30 for the quantity of proof spirit at 55° producible by 100 parts of alcohol. From these data the combinations in the tables may easily be described by equivalent expressions in the language of *per-centages* above and below proof; for having found that 100 parts of alcohol will produce 162·30 parts of proof spirit; if we suppose so much water added to 100 parts of alcohol, that the concentrated mixture is a quantity which requires either to be increased or diminished one-tenth to give the number 162·30, such mixture is evidently ten per cent

* By alcohol is meant the strongest spirit mentioned in Gilpin's Tables, which has a specific gravity of ·825 at 60°, and in this sense the word is used throughout the paper. Alcohol is commonly sold weighing but ·815 at 60°, and it is well known that it can be procured much lower.

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above or *below* proof, according to the definition already given.

To proceed with calculating the places of the divisions on one of the correcting scales, say the ascending, supposing that the counterpart of the indicating scale is engraved in the manner shewn in figure 2, continue the proof-mark across the correcting scales. It will be observed, that the place of proof is designated by the letter P, and that the figures 1, 2, 3, &c. above and below, signify so much per cent above and below proof, the intermediate marks being tenths per cent. From the point coinciding with proof on the left hand or ascending scale, we will begin to calculate the place of the fourth division, which will correspond with the alteration produced in the apparent strength of proof spirit when it is examined at 51°, which is 4° below the mean; or in other words to find what combination of alcohol and water has the same specific gravity at 51°, as proof spirit has at 55°. To ascertain this, refer to Gilpin's Table, headed 55°, it shows as we have before seen, that 100 parts of alcohol and 80·85 of water by weight, or 100 of alcohol and 66·87 by bulk reduced to 162·30 by condensation compose proof spirit. Observe next what is the specific gravity of this combination, and a short calculation to give the terms intermediate to those in the table, gives ·92196; look now in the Table, headed 51°, and ascertain what proportions in weight have the same specific gravity at that temperature; another short and similar calculation to interpolate the terms, gives 100 alcohol and 78·02 water; find next in the table 55°, what are the proportions in bulk of these weights, which are 100 alcohol and 64·52 water condensed 4·47 by mixture, and leaving 160·05 as the total quantity of spirit; but as this quantity contains as much alcohol as was found necessary for producing 162·30 of proof spirit, it is evident that it is above proof; how much may be ascertained thus; subtract 160·05

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from 162·30, multiply the remainder by 100; and divide the product by 160·05; the quotient is 1·406, showing that when spirit appears proof at 51° it is actually 1·406 per cent above proof; this therefore is the place of the fourth mark above proof on the ascending scale, being that which is numbered 196 in figure 2. To find the fourth point above this, or the eighth from proof, take the last obtained combination in weight, viz. 100 and 78·02, agreeing with 1·406 above proof; observe its specific gravity at 55°; it is ·92025, and the combination in weight, which at 51° has the same specific gravity, is 100 and 75·26. Transfer these terms to the Table 55°, and set down their correspondent values in bulk, viz. 100 and 62.24 condensed 4·38, and producing 157·86 of spirit evidently stronger than the last, because the same quantity of alcohol is preserved in all the cases; repeating the former operation $\frac{100\ (162{\cdot}30-157{\cdot}86)}{157{\cdot}86} = 2{\cdot}813$; 2·813 is therefore the place of the eighth point on the ascending scale above proof; by continuing this process, a series of terms will be obtained rising to about 70 per cent above proof. For the present let it be supposed, that the five first only are found, viz. 1·406; 2·813; 4·192; 5·582; 6·973; from which we learn that spirit which at 51° appears proof is really 1·406 per cent above; that that which at 51° appears 1·406 per cent above is really 2.813 above; that which appears 2·813 above, is 4·192; that which appears 4·192 is 5·582, and that which appears 5·582 is 6·973; but the sum total of these five affections of 4° each, ought to correspond with the amount of alteration produced by 20°; that is to say, that spirit which at 35° or (55—20) appears proof, should be really 6,973 above; this however will not be the case, for observing in Gilpin's Table headed 35° what combination has the same specific gravity (92196) as proof at 55° we find 100 of alcohol and 67·67 of water by weight, composed in bulk at 55° of 100

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alcohol, and 55·96 water, condensed 4·08, and leaving 151·88, which by the former operation

$$\frac{100\ (162{\cdot}30-151{\cdot}88)}{151{\cdot}88} = 6{\cdot}861,$$ appears to be 6·861 per cent above proof; now it is clear, that the nature of the scale requires, that this and the number 6·973 before obtained should be convertible quantities, and, therefore, this method of correction cannot be theoretically accurate; the error may, however, be so divided as to be unobservable, by calculating all the terms at intervals of 20° and then interpolating the intermediate ones; thus the error of 112 or (6·973—6·861) per cent will be divided so that, only one-fifth of that quantity, or ·0224, little more than one-fiftieth per cent, will be the error attaching to a correction for 4° of temperature; in a few instances it may amount to ·033, or one thirtieth per cent; these are however, its extreme cases, and it will be found to amount on an average, to not more than ·010 or one-hundredth per cent.

It now only remains to give one example of each of the calculations necessary for forming the correcting scales; the same principle is pursued in each, but the process is slightly modified, as the term sought happens to be on the ascending or descending scale, and as it is above or below proof, thus making four variations of which the following are examples:

The place of the twentieth division, on the ascending scale, above proof, has been already found to be 6·861, and, against this point on the indicating scale must be placed a mark, the intermediate twenty terms must be interpolated in a ratio similar to that of the five terms of 4° each, already found, viz. 1·406; 2·813; 4·192; 5·582; 6·973; whose progression is as nearly arithmetical as possible, and for all the purposes of an hydrometer, may be considered quite so; indeed it is evident from an examination of these expressions, that the last

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figure of each decimal is incorrect, arising from the unavoidable errors in the tables themselves. It will not be necessary to show how to obtain the fortieth, sixtieth and subsequent divisions in this part of the scale, and there can be no difficulty in again dividing these into smaller terms, corresponding each with 1° of Fahrenheit.

For finding the twentieth place below proof on the ascending scale; having before obtained the component parts of proof spirit, by weight, viz., 100 of alcohol, and 80·85 of water, look in the Table, headed 35° and observe the specific gravity of such a mixture at that temperature which will appear to be ·93036; next ascertain the bulks of spirit and water, which at 55° have the same specific gravity; they are 100 and 79·78, condensed 5·06, leaving 174·72; then

$$\frac{100\,(174{\cdot}72 - 162{\cdot}30)}{174{\cdot}72} = 7{\cdot}109$$ which is the place of the twentieth division below proof. The fortieth, sixtieth, and subsequent places will be found in the same manner, and the intermediate points determined as before.

To compute the descending scale, or that which gives the correction for temperature above the mean; beginning with the twentieth place above proof. Refer to the Table, headed 75°, for the specific gravity of 100 of alcohol, and 80·85 of water, which gives ·91322; this at 55° corresponds with 100 of alcohol, and 55·79 of water by bulk or measure, which is condensed 4·08 leaving 151·71.

$$\frac{100\,(162{\cdot}30 - 151{\cdot}71)}{151{\cdot}71} = 6{\cdot}98$$ the required place of the twentieth division above proof; for the twentieth below, find the specific gravity of proof at 55°, viz. ·92196 corresponding to which at 75°, is 100 of alcohol, and 96·67 of water, whose bulks at 55° are 100 and 79.94, condensed 5·07 leaving 174·87

$$\frac{100\,(174{\cdot}87 - 162{\cdot}30)}{174{\cdot}87} = 7{\cdot}188.$$

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The following Tables show the places of each division for an hydrometer, adapted to give the strength of spirits, from alcohol, down to Seventy per cent below proof. They are calculated from Gilpin's Tables, the measures of the alcohol and water being taken in every case to two places of decimals, and the specific gravities to five, one row of figures shows what part of the indicating scale the point should be placed against, the other, the values of the intervals between each successive point.

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ASCENDING SCALE.					
69.86	0.96	28.71	1.23	20.62	1.57
68.90	0.96	27.48	1.23	22.20	1.58
67.94	0.97	26.25	1.24	23.80	1.60
68.97	0.98	25.01	1.25	25.41	1.61
65.99	0.99	23.76	1.26	27.04	1.63
65.00	0.99	22.50	1.26	28.68	1.64
64.01	1.00	21.24	1.27	30.34	1.66
63.01	1.01	19.97	1.28	32.01	1.67
62.00	1.02	18.69	1.29	33.70	1.69
60.98	1.02	17.40	1.29	35.40	1.70
59.96	1.03	16.11	1.30	37.11	1.71
58.93	1.04	14.81	1.31	38.83	1.72
57.89	1.05	13.50	1.32	40.56	1.73
56.84	1.05	12.18	1.32	42.30	1.74
55.79	1.06	10.86	1.33	44.04	1.74
54.73	1.07	9.53	1.34	45.77	1.73
53.66	1.08	8.19	1.35	47.49	1.72
52.58	1.08	6.84	1.35	49.19	1.70
51.50	1.09	5.49	1.36	50.87	1.68
50.41	1.10	4.13	1.37	52.52	1.65
49.31	1.11	2.76	1.38	54.14	1.62
48.20	1.11	1.38	1.38	55.72	1.58
47.09	1.12	Proof.	Proof.	57.25	1.53
45.97	1.13	1.39	1.39	58.72	1.47
44.84	1.14	2.79	1.40	60.12	1.40
43.70	1.14	4.20	1.41	61.44	1.32
42.56	1.15	5.62	1.42	62.68	1.24
40.41	1.16	7.05	1.43	63.84	1.16
39.25	1.17	8.50	1.45	64.94	1.10
37.08	1.17	9.96	1.46	65.99	1.05
35.91	1.18	11.44	1.48	66.99	1.00
34.73	1.19	12.93	1.49	67.94	0.95
33.54	1.20	14.44	1.51	68.84	0.90
34.34	1.20	15.96	1.52	69.70	0.86
31.14	1.21	17.50	1.54	70.53	0.83
29.93	1.22	19.05	1.55	71.33	0.80

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DESCENDING SCALE.					
68.97	0.97	29.48	1.26	20.62	1.55
68.00	0.97	28.22	1.27	22.18	1.56
67.03	0.97	26.95	1.28	23.75	1.57
66.06	0.98	25.67	1.28	25.33	1.58
65.08	0.98	24.39	1.29	26.91	1.58
64.10	0.98	23.10	1.30	28.50	1.59
63.12	0.99	21.80	1.31	30.10	1.60
62.13	0.99	20.49	1.31	31.71	1.61
61.14	0.99	19.18	1.32	33.33	1.62
60.15	1.00	17.86	1.33	34.96	1.63
59.15	1.00	16.53	1.34	36.60	1.64
58.15	1.00	15.19	1.35	38.25	1.65
57.15	1.01	13.84	1.35	39.91	1.66
56.14	1.02	12.49	1.36	41.58	1.67
55.12	1.04	11.13	1.37	43.25	1.67
54.08	1.06	9.76	1.38	44.91	1.66
53.02	1.08	8.38	1.39	46.57	1.66
51.94	1.10	6.99	1.39	48.22	1.65
50.84	1.11	5.60	1.39	49.86	1.64
49.73	1.12	4.21	1.40	51.49	1.63
48.61	1.13	2.81	1.40	53.11	1.62
47.48	1.14	1.41	1.41	54.72	1.61
46.34	1.15	Proof.	Proof.	56.31	1.59
45.19	1.16	1.42	1.42	57.86	1.55
44.03	1.17	2.85	1.43	59.36	1.50
42.86	1.18	4.28	1.43	60.80	1.44
41.68	1.19	5.72	1.44	62.18	1.38
40.49	1.19	7.17	1.45	63.51	1.33
39.30	1.20	8.62	1.45	64.80	1.29
38.10	1.21	10.08	1.46	66.05	1.25
36.89	1.22	11.55	1.47	67.26	1.21
35.67	1.22	13.03	1.48	68.43	1.17
34.45	1.23	14.52	1.49	69.56	1.13
33.22	1.24	16.02	1.50	70.66	1.10
31.98	1.25	17.54	1.52	71.73	1.07
30.73	1.25	19.07	1.53	72.77	1.04

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The points given in these Tables after being each divided into four, and applied to the sides of the indicating scale, are to be numbered, beginning in the ascending scale from the bottom, and in the descending scale from the top. It will be sufficient perhaps to number every fourth division as shown in figure 1, plate XXIV. Figure 3 shows the size which the divisions might be made on the back of a moderate thermometer, by which it will be seen that tenths, or even half tenths, may be read with ease; and it appears that it would be by no means superfluous to use a thermometer sensible enough to show half or quarter degrees, when it is seen that one degree affects the apparent strength of the spirit from three to four tenths per cent; if this were done, it would be necessary that each fourth of the divisions in the above Tables, should be again divided to correspond to the effects produced by half degrees of temperature.

A. Ainger.

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N° XIX.

IMPROVED MODE OF OPENING AND SHUTTING CHURCH WINDOWS.

The SILVER VULCAN MEDAL *was this Session given to Mr.* W. BAILEY, 272, *High Holborn, for an* IMPROVED MODE OF OPENING AND SHUTTING THE WINDOWS OF CHURCHES AND OTHER PUBLIC BUILDINGS, FOR THE PURPOSE OF VENTILATION. *The following Communication has been received from Mr.* BAILEY *on the Subject, and a Model of his Invention has been placed in the Repository of the Society.*

SIR; 272, Holborn, May 7th, 1822.

I WILL thank you, to lay before the Society, the following communication on an improvement in the mode of opening church windows, and other fixed sashes; and which is generally applicable to halls, courts of justice, assembly rooms, and all places that from their crowded state may require extensive ventilation.

To exemplify the operation more fully than could be done by mere description, I have sent a glazed model of a window formed with solid wrought iron sash bars: which bars I have extensively applied in the erection of curvilinear hot-houses, green-houses, and conservatories, their strength and lightness

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rendering them well adapted to the construction of every description of lights and sashes.

It has long been a subject of complaint, that our churches and public edifices, are kept too close and confined for the health and the comfort of the large congregations that assemble in them. Various contrivances attached to the windows, for the emission of the foul air, and the admission of fresh air, so necessary for the purpose of ventilation have been adopted, and more particularly in our churches, but none of them have been applied where their action would be most efficacious; which is at the upper portion of the window, and few of them without producing effects equally inconvenient as those they are intended to remedy.

The old mode was, by means of casements hung upon hinges, and fastening with a latch, these to be within reach were necessarily placed very low, and consequently when opened produced only a trifling ventilation, while the admitted air coming immediately on the persons near them, was extremely inconvenient, and prevented the casements being often opened.

A later and improved mode has been to hang the casements to swing on center pivots, and to place them about the middle of the windows, so that when open one part of the casement is on the inside of the church, and the other part on the outside. This mode is liable to the objection of the air falling on the heads of the persons assembled, and its affording no defence against the admission of a shower of rain. These casements also require pullies and lines, hanging in the middle of the window to open and shut them, operations generally accompanied with considerable noise and consequent disturbance.

Another mode that has been lately very much adopted is to cut out of the windows, a space to receive the half of a glazed hopper, which is attached to the window projecting inwards,

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having a flap on the top, lying horizontally, and opening upwards. These hoppers are extremely unsightly in themselves, but are rendered still more so by the dust which falls and lodges on them, and they are subject to the further inconvenience of the dust being blown into the church when the flap is raised for the admission of air.

I flatter myself on the inspection of the model which I have the honour of submitting to the Society, it will be found that the above stated inconveniencies are obviated and a ready mode of action on the upper part of the window is obtained, by means of simple and effective machinery, while the symmetry of the window is preserved. It may be proper to observe, that in case of the upper part of the window being square, and not having any mullions, it will be found necessary (to prevent the entrance of the air at the sides of the casement when it opens), to have a frame with two angular glazed sides attached to the windows, and these sides must have a small return rebate for the casement to fall against when it is fully opened, which will effectually prevent any inconvenience arising from the form of the window.

I am, Sir,
&c. &c. &c.
WM. BAILEY.

A. Aikin, Esq.,
Sec., &c. &c.

P. S. I have inclosed a certificate from the minister and churchwardens, of the parish of St. Anne's Aldersgate street, who have had these windows in use since 1820.

CERTIFICATE.

Vestry-room of St. Anne's,
April 24th, 1822.

SIR;

WE beg to certify, that Messrs. Baileys, in the summer of

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1820, fixed in the church of the united parishes of St. Anne's St. Agnes, and St. John, Zachary, four of their iron-sash-bar-windows, with opening casements, which have been found to answer the purpose extremely well, and we think are so much superior to the windows commonly used in churches, and the usual modes of admitting air into them, that if they were generally known they would be universally adopted.

We are, Sir,
&c. &c. &c.

JAMES HUTCHINS, A.M. *Minister.*
W. MATTHEWS, } *Churchwardens.*
T. MAYFIELD, }

A. Aikin, Esq.
Sec. &c. &c.

References to the Engraving of Mr. BAILEY'*s improved Mode of Opening and Shutting the Windows of Churches, and other Public Buildings*—Plate XXI.

Fig. 1 is a front inside view of a window, with the apparatus attached.

Fig. 2 is a lateral view of the apparatus.

a is the flap of the window open, forming an angle of about 45 degrees with the plane of the sash.

b b a bar to which the base of the flap is fixed and on which it turns.

c a lever, having one end fastened to the extremity of the bar *b* and furnished at the other end with an eye, which receives the pin or stud *d*. This stud is fixed on the vertical rod *e*, which terminates below in a rack *f*, and is secured in an upright position by the loops or guides *g g* through which it passes.

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h is a lanthorn pinion of two teeth, which when turned round by means of the winch *i*, take into the notches of the rack, and consequently draw down the rod *e*, or raise it, according to the direction in which the winch is turned.

In the first case the stud *d* draws the lever down, and consequently opens the window, which is the position represented in the plate; in the latter case the stud is raised and with it the lever, which closes the window.

Fig. 3 shows the rack with the parts connected with it on a large scale. *k* is a section of the lanthorn pinion, showing how its two teeth interlock with those of the rack so as to support the rack: the teeth are adjusted in such a manner that when the window is closed, the two teeth of the pinion are in a vertical position; this is necessary, because a two-leaved pinion cannot remain at the quarter turn.

Fig. 4 is a section of the box, in which the rack and pinion are contained (a front view of the box being shown in fig. 1). The square end of the axis of the pinion projects beyond the box, for the purpose of conveniently receiving the winch, and may itself be enclosed in a barrel to prevent it from being bent by any accident.

Fig. 5 shows the two-leaved pinion detached from the other parts of the apparatus.

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PAPERS

IN

MANUFACTURES.

No I.

IMPROVED BLOCKS FOR CALICO-PRINTERS.

The Sum of FIFTEEN GUINEAS *was this Session given to Mr.* STEPHEN MARSHALL, *of Merton Bridge, Surrey, for his* IMPROVED BLOCKS FOR CALICO-PRINTERS, *a Set of which has been placed in the Repository of the Society.*

THE more complicated patterns of printed calicos consisting of figure work and stripes, require the application of two or more blocks; the stripe, or rather three or four parallel stripes, being cut on one block, and the figure-work on another; but where the stripes are cut on a single block the distance between one stripe and another is not susceptible of variation, and therefore can be used in conjunction with those figure-blocks only, the intervals of which correspond with those of the stripe-blocks. In order to render these more extensively applicable,

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and at the same time to allow the printer to adjust the intervals of the stripes at pleasure, an improvement was introduced of forming the stripe-block of three separate pieces (corresponding to the number of the stripes) having a horizontal hole bored through them at each end, through which two wooden pins being run, united them into one block, at the same time allowing the printer to set the intervals of the stripes so as to fit those of any particular figure-block which he was desirous of employing.

This advantage had its correspondent inconveniencies; the pieces of the compound block were apt to warp, and thus to injure the parallelism of the stripes; the wooden pins which united them soon became dry from the necessarily high temperature of the workshops, the pieces then got loose, and caused irregularities in the pattern, and when this happened the only remedy was to soak the blocks in water till the pins had swelled, and became sufficiently tight again to retain the pieces at their proper distances; in consequence of which much time was lost to the workman.

Mr. Marshall has discarded the wooden pins heretofore used, and unites the pieces of the stripe-blocks by means of bolts and screws and nuts of metal; the consequence is, that not only are they prevented from warping, but they may be adjusted to any required interval with the utmost precision; a farther advantage also is, that the workman may by this means manage a block of five stripes with the same ease as he now does one of three stripes.

Ample testimonies of the probable advantages of this new invention were forwarded to the Society, by

Mr. Edwards, *of Wandsworth Calico Print Works*
Mr. Geo. Ansell, *of Carshalton.*
Mr. Audsley, *of Crayford.*
Mr. Haite, *of Merton Abbey*, and
Mr. Whitehead, *of Crayford.*

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Reference to the Engraving of Mr. MARSHALL'S *Blocks for Calico Printing.*—Plate I.

Fig. 9 is a back view of the block with five rows or boards. Fig. 10 a side view *a a a a a* the boards; *b b* fig. 10, the facing of close-grained wood; *c c* a back-board screwed to the middle bar, with notches at *d d d d* for the side bar screws to slide in; *e e e e* two copper bars passing through the five wooden bars, and fixed to the middle one by pins *f f f f*; these with the back-board *c* serve to keep the face of the bars in one plane; *g g g g* two adjusting-screws fixed to the middle bar by a flat part through which a screw passes, and having two nuts for each lateral bar in order to fix it at the required distance. Fig. 11 shows another method of adjusting by which one nut at each end of a bar serves to move or fix them; the nuts have a collar let into the bar, and followed by a brass-plate, so that when the nut is turned by the octagon part which projects through, the bar is moved backward or forward. Fig. 14 shows the plates *h h* on the inside of one of the bars with the nuts projecting through them. Fig. 12 shows the screw with the nuts and section of the plates *h h* detached. Fig. 13 a copper bar which is fixed in the middle wooden bar by a screw passing through them; *i i i i* screws in the other bars which fix them to the copper bars when adjusted.

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Nos II. AND III.

IMPROVEMENT IN THE SILK-WEAVER'S DRAW-BOY.

The Sum of TWENTY GUINEAS *was this Session given to Mr.* E. RICHARDS, *of Bethnal Green, for an* IMPROVEMENT IN THE SILK-WEAVER'S DRAW-BOY.

The Sum of FIVE GUINEAS *was given to Mr.* J. HUGHES, *of Patience Street, Bethnal Green, for an* IMPROVEMENT IN THE SILK-WEAVER'S DRAW-BOY. *A Model of the Improvement has been placed in the Society's Repository.*

IN weaving plain goods of every description composed of silk, wool, hemp, cotton, or flax, the threads composing the warp are formed into two sets, the 1st, 3rd, 5th, &c. forming one division, and the alternate ones, the 2nd, 4th, 6th, &c. forming the other; each set is alternately raised and depressed, and at every crossing of the sets, the shuttle containing a spindle full of thread is shot, or thrown from one hand to the other, distributing the thread in its passage, in front of every intersection of the threads that compose the warp; but in figured silks, the threads of the warp are formed into more divisions than two, the number varying according to the

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pattern; and in order that each division may be raised or depressed with the necessary accuracy, each thread of the warp is passed through a loop in a vertical cord furnished with a weight at bottom to keep it properly stretched, and passing over a support at top. These vertical cords are called the monture, and are collected into as many sets or lashes as the pattern requires; it being understood that the cords of those threads which are to be raised or lowered together are to be included in the same lash. The number of lashes required for very simple patterns on very narrow silks is considerable, amounting to 40, 60, or more; it is obviously, therefore, in these cases, impossible to give motion to the warp by attaching a treadle to each lash. The way in which the lashes were actually raised was, to pass the end of each lash through a hole in a horizontal board, to fix to the lash a piece of wood like a bell-pull, and to employ a boy (thence called a draw-boy) in pulling or drawing down each lash in succession, so that the weaver had only to throw the shuttle, and give directions to his boy.

Each cord of a lash having a weight hung to it, the aggregate weight of the whole lash is considerable; so that the labour incurred by the draw-boy was great, and considerable dexterity (the result alone of long practice) was required to prevent mistakes, and much loss of time. Hence the weavers were very dependent on their draw-boys, and the idleness or illness of one of them threw the weaver for the time out of work.

Various ineffectual attempts had been made to supersede the living draw-boy by machinery, but with little if any success, till Mr. Duff brought forward an engine for the purpose, which was rewarded by this Society in 1816. Mr. Duff's engine by means of a very ingenious contrivance enables the weaver by pressing alternately on two pair of treadles to

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produce the regular elevation and depression of the lashes without the assistance of the boy. The weight of the lashes and the friction of the machine being considerable, it was necessary to adjust accordingly the length of the levers or treadles by which it was put in motion; in consequence of which a tread of 10 inches was thought necessary, that the weaver might not be oppressed by the weight. It was soon however found in practice that the exertion of raising the feet 10 inches for every motion of the treadle was excessively fatiguing to the weaver, and apparently occasioned a predisposition to rupture, so that the machine came only into very limited use.

About two or three years ago, Mr. Jones, since dead (an engine-maker), attempted to shorten the tread, by fixing on the axis of the driving wheel two cranks each about $\frac{2}{3}$ of the length of the radius of the wheel; but the mechanical disadvantage at which they worked, and the manner in which they were connected with the treadles increased the weight and friction so disproportionately to the advantage gained by shortening the tread, as to render it wholly inapplicable in practice.

About last Christmas, Mr. Hughes, a weaver, fixed a small grooved wheel on the axis of the driving-wheel, and connected it to the treadles by means of two cords passing over pulleys. It might be supposed that any advantage thus gained by shortening the tread would be counter-balanced by the increased weight required to be overcome. This, however, is not practically the case; when the thigh of the weaver is raised so as to be nearly horizontal, as necessarily happens at the commencement of a tread ten inches in height, the muscular force which can be exerted by a given effort is far inferior to that which an equal effort will produce in a tread of five inches; and hence, although the weight to be raised increases

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in proportion to the difference between the diameters of the driving-wheel and of the small wheel, or pinion, yet the muscular advantage gained nearly counterbalances this increase of weight. A real practical advantage, therefore, resulted from Hughes's invention, although the mechanism employed is unnecessarily complicated, and not judiciously disposed, since by means of it work which could not before be wrought by the machine may now be performed by it.

In order to relieve the weaver still farther by diminishing the weight on the treadle, and thus adapting the machine to heavier patterns and wider silks, Mr. Richards, in 1820, attached to the prolonged axis of the machine, an arm carrying a leaden weight of such a magnitude as to counter-balance that of the lashes. The practical advantage of this contrivance was however diminished by the weight being fixed in an inconvenient situation, and being liable to jar the machine, in consequence of which in March 1821, Mr. Hughes removed it from its original place, and fixed it within the frame on one of the driving-wheels. A still further improvement in its position was subsequently made by Mr. Richards, who has prolonged the axis of the driving-wheel, giving it the form of a quadrilateral prism, and on any part of this axis which local circumstances may point out as most convenient, the counter-weight may be fixed by screws farther from or nearer to the center of motion according to the magnitude of the weight required to be counterpoised.

In order to render the above-mentioned improvement more intelligible not only to the silk weaver, but to the public in general, it has been thought fit to give a representation, showing the connexion of the immediate subject of reward with the whole apparatus for weaving silks as now employed in Spitalfields. The Committee of Correspondence and Papers, were the more readily induced to adopt this measure,

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as hitherto no correct representation of the silk loom and draw-boy has been published.

References to the Engraving of a Silk Loom for weaving figured Silk, with Mr. RICHARDS'S *Improvements on the Draw-Boy.* —Plate III.

Fig. 1 represents a cross section of the draw-boy at the dotted line *a a*, fig. 2, with a side view of the loom, &c.

Fig. 2 is a section of the loom at the dotted line *b b* fig. 1, together with a side view of the draw-boy.

Fig. 3 is a plan of the draw-boy, with part of its frame.

Fig. 4 is a longitudinal section of the axle, &c., of the draw-boy.

Fig. 5 is a cross section of the axle of the draw-boy and figure-box.

Figs. 1 and 2 are drawn to a scale of ¾ of an inch to a foot, and figs. 3, 4 and 5 to a scale of 2 inches to a foot.

The same letters of reference refer to the same parts in each figure.

A A A, is the frame of the loom, B the roll or beam on which the warp is put, C the cloth or breast roll, D D the lay or bottom, E the reed, F F a frame which supports and regulates the table of mullets; G the table, which consists of a number of thin bars fixed in a frame nearly in a vertical position, but which can be elevated or inclined at pleasure by a hoop H; between each of these thin bars are placed one, two, three, or more small mullets or pulleys *c c c*, over which pass the horizontal strings or tail *d d d*, by which the lambs or headdles I I J J and K K are suspended. To weave plain cloth, only two leaves of headdles are really necessary; but in fine

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webs, where many threads are contained in the warp, the number of headdles required in one shaft would be so great that they would be crowded together, which would cause unnecessary friction and strain the warp: for this reason, a greater number of leaves is used in weaving figured silks, &c.; the number of these leaves is so great, that the shafts on which the headdles are placed, are obliged to be arranged in two three or more stages, one above another, as shown in figs. 1 and 2 at I I, J J, K K, so that when the lowest set of headdle shafts I I are raised to make the sheds or opening in the warp through which the shuttle passes, they are in the situation of those at *i i*, and do not rise so high as to interfere with those at J J, and when those at J J are raised to *j j*, they do not interfere with those at K K, and those at K K will be raised to *k k*, so by this arrangement there will be three times the number of the leaves of headdles in nearly the same space as when placed on the same level.

To each of the lower treaddle shafts are suspended three long small leaden weights *l l l*, so as to keep the treaddles straight and perpendicular. The strings *d d d* which suspend the treaddles are extended across the room, and are made fast to a horizontal rod L, which is also fixed by cords to the side of the room; M is a bar or roll which is suspended from the ceiling of the room to support the strings or tail *d d*, &c. N is another roll which is itself supported by a frame from the upper part of the loom, and supports the strings *d d*, &c. when the depression is made on them, by the action of the foot on the treaddles O O, P P, Q Q, from which the motion is communicated to the draw-boy, &c. R R is the frame of the draw-boy, which must be fixed to the floor.

S is a square wooden bar, or axle of the draw-boy, mounted so as to turn backwards and forwards on two screwed centers *e e*, figs. 2, 3, 4, fixed in the ends of the frame R R. There are

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also fixed to each end of the frame R R, and concentric to the axis of the screwed centers *e e*, a cylindrical ring *m* and *n*, figs. 3, 4, of brass or iron; one end of each ring is made flat, with an internal flanch for fixing it to the end of the frame, and the other ends of the rings are formed into inclined planes. On the upper side of the axle S are inserted in two parallel grooves, two wooden racks *f* and *g* fig. 3, so as to slide easily backwards and forwards; the upper edges of the racks have teeth similar to those of saws, but the inclined side of the teeth in each rack is in contrary directions; to one end of each rack is fixed a piece of brass *o* and *p*, and rounded off on the end, so as to act smoothly on the circular inclined planes *m* and *n*: beneath the racks are concealed two spiral springs *h h*, the action of which tends to press the brass ends of the racks against the inclined planes *m* and *n*.—T is the draw-boy or bow, seen best in fig. 5, which consists of a semi-circular piece of iron or brass, with a groove in the periphery like a pulley, and each of its ends are divided so as to form cleft hooks, or claws, which clip the strings or lashes above the knots *r r*, so that when the axle S is made to vibrate, the hooks *q q* first draw a lash or string on one side, and then on the other, alternately.

The draw-boy or semi-circle T is fixed on a carriage U, called the figure-box, which slides easily upon the axle S, and has two clicks or catches, *s* and *t*, in the inside of the box, with a string pressing on the upper side of each, and causing the clicks to act on the teeth of the racks *f* and *g*. V is a roller supported by its pivots on the upper side of the carriage U, having the two pins or levers *u* and *v*, fixed in it, opposite to each other, and projecting over the ends of clicks that act on the racks; on the upper side of each click is fixed a hook or staple which connects the clicks to the levers *u* and *v*, so that when the lever *u* is depressed, the click *s* is at liberty to act on the teeth of the rack *f*, and at the same instant the lever *v*

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will be raised, and disengage the click *t* from the rack *g*, and when the lever *v* is depressed, the click *t* will be at liberty to act on the teeth of the rack *g*, and the click *s* will be disengaged from the rack *f*, consequently only one of the clicks can act on the racks at the same time. The roller V is kept in either situation, by the action of a spring 1, figs. 3, 4, fixed on the upper side of the figure-box or carriage U, and having a double inclined plane on the under side of it near the point, the middle of which is situated over the pivot in the end of the roller V, and acts on a small pin which is fixed in the end of the roller, and on the upper side, and also over the center of the pivot, when the levers *u* and *v* are horizontal; consequently when the lever *u* is depressed, the pin in the end of the roller will be turned in the same direction, and the inclined plane nearest the point of the spring 1 will retain it in that situation till the lever *v* is depressed, which will cause the pin to raise the spring 3, and pass to the other side of the inclined plane, when it will again be detained till the carriage has arrived at the other end of the axle S. On the under side of the roller V, and at right angles to the levers *u* and *v*, is fixed another pin or lever *w*, which passes through a hole or short slit in the middle of a small bar *x*, which is placed a little below and at right angles to the axis of the roller, and also passes through each end of the box U, and is at liberty to slide backwards and forwards, so that when the box or carriage U has traversed over the number of teeth required in the rack, the end of the bar *x* comes in contact with a spring *y* (which is fixed on the axle S between the racks) and depresses it till it overcomes the resistance of the bar *x*, &c. which will be thrust forwards, and act on the pin as in the underside of the roller V, and also turn the roller in the same direction as by depressing the lever *v*, which will disengage the click *s*, and engage the click *t* in the rack *g*; then the carriage will

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be in proper trim for traversing to the other end of the axle S, which is performed by the action given to the treaddles, which is also communicated to the pulley 2, on the end of the axle S, and therefore causes the axle to vibrate half a turn each motion of the treaddles; as the axle is in the act of turning in the direction of the arrow, the circular inclined plane *n* acts against the end of the rack *g* and pushes it along the groove in the axle S, together with the carriage U, &c. equal to one notch or tooth of the rack; when the axle has returned half way, the spiral spring *h* presses back the rack *g* to its former situation without moving the carriage U on the axle S (as the rack is at liberty to slide in that direction under the click without butting against one of the teeth), and by repeating another vibration of the axle, the carriage will be moved forward another tooth, one tooth each vibration, and so on till the carriage has arrived at the other end of the axle S; then the other end of the bar *x* will be brought in contact and pushed against a spring *z* (which is fixed on the upper side of the axle between the racks at any required distance from the spring *y* between the racks according to the number of strings or lashes *r r* that the figure may require) till the spring overcomes the resistance of the bar *x*, &c. which turns the roller V, and changes the action of the clicks *s* and *t*; then the carriage U will traverse back one tooth for each vibration of the axle S, by the action of the circular inclined plane *m* on the rack *f*, till the end of the bar *x* comes in contact with the spring *y*, when the actions of the clicks *s* and *t* will be again changed.—The racks *f* and *g* both slide backwards and forwards the extent of a tooth, by the action of the two circular inclined planes *m* and *n* for each vibration of the axle; but as only one of the clicks is allowed to act on the rack at the same time, the motion of the other rack does not interrupt the progress of the carriage U, &c. The frame which contains the joint end

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of the click *s*, can be so adjusted by the screw 3, that the carriage U will be stopped by each vibration of the axle S, in a situation differing by half a tooth, according as it traverses one way or the other; so that a different set of strings, or lashes *r r*, &c. will be drawn at each vibration of the axle, till the carriage U has traversed backwards and forwards on the axle S. W and X, are two rails of wood fixed on the upper side of the frame R R of the draw-boy, and parallel to the axle S: on the inner edge of the rails are fixed double the number of wire staples 4 4, &c. to that of the teeth in the racks *f* and *g*; the staples 4 4, &c. act as guides to the strings or lashes *r r*, which pass through them, and are fixed to the rail Y, which has four rows of holes through which the strings *r r*, &c. are passed and retained by a knot on the under side of the rail; the number of holes is equal, and opposite to those of the staples 4 4, &c., and is also parallel to the axle S. In the ends of the rails W and X are slits, through which the screws 5 pass that fix them to the frame, so that the staples 4 4, &c. in the rails can be adjusted opposite to the groove in the periphery of the draw-boy: 6 6 are two thin rails, or false tail boards, which are also fixed on the upper side of the frame R R, and parallel to the rails W and X. The strings *r r* being made fast to the rail Y, and passed through their respective staples 4 4, &c. have another set of strings tied to them at 10 10, called the false tails, which are passed over and through guide staples on the upper sides of two smooth round rods or arms 8 8, and then passed through the holes in the rails 6 6, and to the ends of the strings are appended small leaden weights or lingots, 9 9, &c. which draw the strings *r r*, &c. so as always to keep them straight; one end of the rods or arms 8 8 is attached to the upper part of the frame of the loom, and the other ends are suspended by strings from the ceiling of the room; to the upper ends of each of the

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strings *r r* at 11 11, is tied another series of smaller strings or lashes 12 12, the upper ends of which are also tied to certain horizontal strings *d d*, &c. which pass over the pulleys in the table G, and have the lambs or headdles suspended from them; by this arrangement it will be seen that when one of the strings *r* which is fastened to the rail Y is pulled down (by the action of the draw-boy or bow on the upper side of the string *r*) it draws one of 10, lifts one of the weight 9, and raises such an arrangement of the lambs or headdles as is proper to produce the figure which is to be woven.

When the draw-boy T and axle S are returned to the situation as shown in fig. 5, the weights *l l l* which are suspended from the lambs, and those at 9 9 will replace the lambs, lashes, &c. in their former situation.

In weaving heavy silks, or what is termed three, four, or more doubles, that is, so many double threads between each split of the reed; the power required to depress the treaddles is so great, that the weaver was obliged to have the assistance of a boy to turn a winch, which was fixed on the end of the axle S which passed through the end frame of the draw-boy.

The application of the winch to the draw-boy was the invention of John Sholl, who was rewarded by the Society of Arts, &c. in the year 1810.

Mr. Richards being a machine or loom-maker, observed the great difficulty of getting boys to attend their work, together with the expense, which caused him to turn his attention to the subject, and he has been successful in making the machine so perfect and powerful as to supersede the necessity of a boy.

The following are Mr. Richards's improvements on the draw-boy:—

The power which is to be applied to the treaddles O O is communicated to the treaddles P P by the cords 13 13, and from the treaddles P P to Q Q by the cords 14 14, and from

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the treaddles Q Q to the pulley 2 (which is represented by the dotted circle) by the cords 15 15, which are tied to the treaddles Q Q, and passed over two small guide pullies (the frames of which are fixed to a cross bar of the frame R R); then one of the cords is passed under, and the other over the pulley 2, and fixed to the heads of two screwed nails which are screwed into the grooves in the periphery of the pulley 2; the pulley 2 is fixed to the side of another pulley 18, eccentric to the axis of the axle *s*, by which means the power to turn the axle of the draw-boy increases as the treaddles are depressed.—Z is another axle which turns on two conical steel centers, similar to those which support the axle S; to one end of the axle Z is fixed an iron wire 19, having a slit along it, through which a screw passes for fixing a weight 20, at any required distance from the center of the axle; on the other end of the axle Z is fixed a pulley, 21, perpendicular to the pulley 18 on the axle S, each of which has two grooves on their respective peripheries; 22 and 23 are two cords which are passed round the pullies in contrary directions, the upper ends are fixed to the pulley 18, and the lower to 21; by which means the motion of the axle S is communicated to the axle Z. Now, suppose the treaddles were level with each other, the weight 20 would be perpendicular above the axle Z, and would tend to turn it either way; consequently, as one of the treaddles is depressed, the weight will pass to one side or the other of the axle, and its leverage power will be increased till the center of gravity of the weight 20 has arrived horizontal with the axis of the axle Z; it will be obvious, that either by increasing the weight 20, or extending it further from the axle, the power will be encreased; and by combining the eccentricity of the pulley 2 with the eccentricity of the weight 20, the power applied to the treaddles may be increased so as to counterbalance any number of lambs or headdles, and the weights

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appended to them, and to the false tail, together with the power required for raising or opening the warp for the shuttle to pass through.

Another of Mr. Richards's improvements is the application, with certain modifications, of box 24, called the tabby-box, which is fitted to the axle S, and has a semi-circle 25 fixed to it, similar to the figure-box, but without the clicks, &c. To the under part of the box 24 is fixed a wire rod 26, which passes easily through the figure-box and is supported by a staple 27 near the end of the axle, through both of which it is at liberty to slide to and fro.

28 and 29 are two sliding sockets which can be fixed on the wire in any required place by a set screw in the side of each.

The use of the tabby-box is, to raise a certain set of the lambs or headles to work the plain part of the silk between the figures without having so much lash tied to each of the strings *r r*, &c. To adjust the tabby-box for weaving figured cloth with a plain ground, the two sliding sockets 28 and 29, must be fixed on the wire rod 26, in their situations as shown in fig. 4; two strings or lashes must also be fixed in a similar manner as those already described at *r r*, on each side of the axle opposite the tabby-box, and passed through the staples 30 and 31, see fig. 3 (only part of the rails on one side of the axle which the staples are fixed in is shown here, but the other side is fitted up in a similar manner). Suppose the loom was all ready prepared to weave the figure as represented at fig. 6, and to commence at the line 30; the treadles being put in motion, will cause the axle to vibrate, the draw-boy or bow T, on the figure box U, will draw every other string or lash *r r* on each side of the axle S, alternately, till the box U has arrived at the spring Z, and raises such an arrangement of the lambs or headles, as is proper to produce the figures in

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the squares 33 33; at the same time the bow or semi-circle 25, on the tabby-box is drawing the strings or lashes 31 31, on each side of the axle alternately, and raises such an arrangement of the lambs, as to produce the plain part of the cloth in the squares 34 34. At the instant the end of the small bar *x* in the figure-box U, comes in contact with the spring *z*, (on the upper side of the axle S) the same end of the figure box on the under side of the axle also comes in contact with the socket 29, and at the next vibration of the axle, the rack *g* will press the figure-box U, together with the tabby-box 24 forward on the axle, equal to one tooth of the rack, when the action of the clicks in the figure-box will be changed, and the bow or semi-circle 25 on the tabby-box will be opposite the staples which contain the strings or lashes 32 32, and will remain there and draw the lashes on each side of the axle alternately, and raise such an arrangement of the lambs as to produce the plain cloth in the squares 35 35, and at the same time the figure-box U will be traversing to the other end of the axle, and the semi-circle T will be drawing the lashes *r r* on each side of the axle alternately, which it skipped when it traversed the other way, by which means a new arrangement of the lambs will be raised, so as to produce the figures in the squares 36 36. When the other end of the small bar *x* shall be brought in contact with the spring *y*, at the same instant the end of the figure-box will be in contact with the socket 28, and the next vibration of the axle will cause the rack *f* to push the figure-box, together with the tabby-box, along the axle S equal to one tooth of the rack; then the tabby-box, together with the wire rod and sockets, will be in their former situations, as shown in fig. 4; and the action of the clicks in the figure-box will again be changed, and the whole figure completed, and the machine ready to produce a similar set of figures to those already described.

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N° IV.

IMPROVED RIBBON LOOM.

The GOLD VULCAN MEDAL *and* FIFTY GUINEAS *were this Session given to Mr.* J. THOMPSON *of Coventry, for an* IMPROVEMENT IN THE LOOM FOR WEAVING SILK RIBBONS. *Specimens of Work produced by Mr.* THOMPSON'S LOOM *were laid before the Committee, which, with a Model of the Machine, have been placed in the Repository of the Society.*

IN weaving figured ribbons, the same general process takes place as in weaving figured goods of all kinds; that is, the warp is arranged into two sets of threads which cross each other, but instead of the shuttle which carries the cross thread or shoot, passing at each throw between all the threads which compose the sets, certain of the threads are raised out of the line of the shuttle's passage, which forms that irregularity in the texture of the fabric which constitutes the pattern.

The raising the threads of the warp is effected by passing them through loops in vertical cords, each cord having a leaden weight suspended to it, in order to make it hang perpendicular and move freely, while the other end of the

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cord is connected with a lever, worked by a treadle, so that the weaver when pressing on a treadle raises all the cords attached to that lever, together with their threads, and when his foot is taken off the treadle the threads fall down again into their proper place by the gravity of the leaden weights fixed to the ends of the vertical cords.

Hence the natural limit to the fineness and length of the pattern or figure is the utmost number of treadles that can be conveniently managed, and the greatest weight that can be conveniently raised by each treadle. The machinery of the common English ribbon loom is such that, in order to keep the treadles within a reasonable number, and at the same time to allow of a proper length of figure, four threads of the warp are passed through each loop: hence, necessarily results a certain coarseness of work. In Mr. Thompson's machine a cord is appropriated to each thread, it can in consequence produce figures much finer than any heretofore made in this country, and of larger size. The time required for mounting the loom is not greater than usual, regard being had to the nature of the pattern. Eight treadles in Mr. Thompson's engine do the work of thirty two treadles in the common one, and hence the former is less laborious to the weaver in making those patterns that are common to both engines; but the usual one is limited to forty lashes, whereas the improved one extends to 180 lashes, so that it is capable of producing work of greatly superior richness and fineness. The common loom makes only one ribbon at a time, and produces at the rate of about 1½ piece per week; Mr. Thompson's makes four at once, and though the same time is required in piecing threads, removing knots, &c., in one case as in the other, yet the rate of work in the new loom is four pieces per week; another advantage attending it is, that it allows the weaver

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to put any quantity of plain work that he pleases between the pattern without changing the figure, by means of which if the loom when mounted for any figure proves too heavy to be conveniently managed by the weaver, the weight may be diminished merely by increasing the relative proportion of plain to figured work. Lastly, the weaver may instantly throw off the figure altogether, and produce plain ribbons whenever work of this kind is required, whereas all the present figure-looms must continue making the particular figure for which they have been mounted.

Reference to the Engravings of Mr. THOMPSON'S *Ribbon Loom.* Plates 4, 5, 6, and 7.

Figures 1 and 2, plate 4, are a side and front elevation of the most improved engine-loom for weaving figured ribbons, as now used at Coventry. The particular invention in question is comprised in the machinery, situated above the rails *a a*. This part, of which a detailed description will be given in references to the three following plates, will be rendered more intelligible by a previous explanation of those other parts of the loom, to the use of which it is made subservient. The framing of the loom is marked with the letters *b b*, &c. on the various rails and posts; *c* is the weaver's seat; *d* the *breast piece*, shown in section at figure 3; *e e* is the *warp*, which being wound on separate rollers *f f*, passes round the roller *g* (extending from one side of the loom to the other), is acted on by the *leashes* or *harness* at *h*, receives the *shoot* from the *shuttles* at *i*, and being now formed into ribbon, passes round a fillet on the upper surface of the breast piece *d*, through a

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sloping mortise cut in the same (see fig. 3) and is finally received on to the roller *k*. The warp is kept in a state of tension by cords and weights *l l*, fastened at one end to the rail *o*, and passing round the left hand ends of the rollers *f f*, &c.; these cords and weights are omitted in figure 2 to avoid confusion. The parts *m*, *n n*, *p p*, *q q*, are the *swinging beam*, *swords*, *planks* and *blocks* of the *batten*, the whole of which swings on centers at *r r*, and alternates at every motion of the shuttle, its extreme inclination to the right being nearly as much as it is shown in the engraving to the left. The shuttles have grooves in their upper and under surfaces which receive the thin edges of the planks *p p*, and by which they are retained in their places. The shuttles are impelled by the handle *s*, which moves two rails, one *in* the upper, and the other *on* the lower block *q*; between these two rails, and uniting them together, are four iron *driving teeth*, which have an extent of motion equal to the space between the apertures *t t*, in the planks; the driving teeth striking against the back edges of the shuttles, follow them to the verge of those apertures, and the shuttles proceed quite across by the impetus already given to them. The shuttle carries in a cavity the silk called the *shoot*, viz. that which lies across the ribbon, and is interlaced with the warp which lies lengthwise; the shoot is wound round a small reed, called a *quill*, which runs on a wire axle in the cavity of the shuttle, and to which a certain degree of friction is given by a slight spring; the friction is overcome by the motion of the shuttle, the quill revolves, and enough shoot is given out for the width of the ribbon. The apertures *t t* are occupied by exceedingly fine steel gratings, called *reeds* (from their having been formerly made of split reeds); through these the threads of the warp pass, and by them they are kept separate,

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each thread passing through its own opening. That portion of warp which is lifted at *h* by the leashes or harness, takes the position shown by the upper dotted lines, the two portions forming an opening sufficient to allow the free passage of the shuttle. After each *shoot*, as the throwing of the shuttle is called, the batten is drawn forward by the weaver's hand with some force to press *the shoot* close into the intersection of the warp, which it does by means of the reed in the aperture *t*. This motion of the batten has within a few years been made available in winding up the work as it is finished, instead of its being done occasionally by the weaver's hand. For this purpose a small arm *u*, with notches in its upper edge is fixed to the axle *r* of the swinging beam, and from it depends the loaded cord *v v*, passing in its way once round the roller *w*, which receives in consequence at every recession of the batten a certain motion, the quantity of which is determinable by the notch on which the cord *v v* is hung. On the axis of the roller *w* is fixed an endless screw, acting in a toothed wheel fixed on the axis of the roller *k*, which therefore takes up the ribbon as fast as it is made. The transmission of the advancing motion of the batten to the roller *k* is prevented by the friction of a second loaded cord *x x*, which is fastened at the upper end to the framing of the loom, and passes once round the roller *w*, in the same direction as the first.

Before describing the apparatus, which, acting on the warp previous to its receiving the shoot, determines the figure to appear on the surface of the ribbon, it may be useful to state generally, that the figure is produced by bringing different portions of the warp above the surface at every shoot. All the fibres of the warp pass through distinct loops or *eyes* in as many upright threads, called the

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leashes or *harness*, shown in the engraving at 1 1, to each of which is hung a long thin leaden weight, called a *lingo* 2, 2; the leashes or harness to each of the four ribbons are at the parts 1 1, arranged in a mass in the form of a parallelogram, in consequence of their passing through holes, disposed in that manner in a board 3, 3, called the compass board, which has a notch cut in it for each harness; the notch is filled in with a piece of thin hard wood, in which the perforations are made for the leashes; a section of the board at this part is shown in fig. 4. The harness after passing through the compass board upwards, branches into different directions to suit the nature of the action it is to receive from the machinery above. If, for instance, the ribbon is to have a figure in the middle only, the sides being plain (as we have supposed in the present case, and as the engravings describe it) the outer portions of the harness containing that part of the warp destined for the edges of the ribbon is separated from the rest, and attached to cords 4, 4, which are connected with the machinery above, in a manner which will be hereafter described. These cords are necessarily omitted in the side view, as they would each of them be repeated sixteen times. The harness next passes through holes arranged in two rows in the *leash board* 5, 5, and the threads are so disposed in this board, that the situation of each, with respect to the warp, is easily known by counting; that is to say, it is easily known in what part of the ribbon that fibre of warp lies, which will be acted on by any particular thread of the harness. Immediately above the leash board 5, 5, are seen knots; at these knots every thread of the harness branches out into four slight lines, each passing through a different row of holes in the *lash* board 14, 14. We have said that from the knots above the leash board

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5, 5, each thread branches out into four; this is not strictly the case; because as the harness of two similar patterns meet in the board 5, 5, two threads pass through each hole, the two being of course those which apply to the same part of the figure in the two ribbons, and each of these pairs being knotted together, are connected with the four slight lines above-mentioned. We must now re-commence from the top, and trace the connection of the machinery and its dependent apparatus downwards till we meet the leash board 5, 5.

There are sixty four cords, 6, 6, &c. four shewn in the front view and sixteen in the side; each of these cords is raised in succession, and in the particular machinery for doing this is comprised the whole of the present invention, all the other parts of the loom being such as are in general use. Sixteen treadles 7, 7, depress successively, each of sixteen levers, called *lambs* 8, 8, hung on small iron axles, fixed in uprights, attached to the framing of the loom. The left foot treadles are connected by cords 9, 9, &c. with the upper tier of lambs, and the right foot treadles by similar cords 10, 10, &c. to the lower tier. From each lamb ascends a cord 12 12, branching into two at the upper end, and connected with the inner extremities of the tumblers A, of which there are thirty two (sixteen on each side). The sixteen *treadle cords* 12 12, &c. are omitted in figure 1, and being arranged in a straight line, only one can be seen in figure 2; it is for the purpose of their thus forming a straight line that the lambs are interposed between them and the treadles. Each of the tumblers A is moved in succession by the treadles respecting which it may be observed, that the weaver begins with one of those at the outside, next takes the other outside, then those respectively within the first and

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second, and so on till his feet meet in the center; after which he again re-commences from the extremes.

Sixteen or twenty treadles are as many as can be conveniently and effectually worked, but a pattern or figure of moderate length requires from sixty to one hundred and twenty different shoots, it is necessary, therefore, to convert the sixteen or twenty movements obtained by the treadles into sixty or one hundred and twenty different actions on the harness. Some persons have accomplished this by an application of the *draw-boy* rewarded many years since by the society, and an improvement on which is described in the present volume. This application, however, besides being the subject of a patent, is destitute of several advantages belonging to the present invention, which is shown on a larger scale in the plates 5, 6, and 7. In these engravings it will be observed, that not merely are the same parts in the different plates referred to by the same letter, but where there are two or more similar parts they are denoted by the same letters and are individually distinguished by an added figure.

Plate V is a bird's-eye view of the apparatus: figure 1 of Plate VI. is a side elevation; and Plate VII. is one half of it front elevation, and the other half a vertical section through the dotted lines Z Z Z in figure 1, Plate VI. In all these A1, A2, &c. are thirty-two *tumblers* moveable on axles at their centers, by means of the treadle cords 12 12, &c., attached to their inner extremities; at their outer extremities they are connected by similar cords to the sixteen *lifting shafts* B 1 B2, &c., from which depend (by cords shown in the sectional half of Plate VII.) thirty-two *lifting irons* C C, &c.; D D, &c. are eight upright posts, each having a groove in its inner face for the following purpose. It is necessary that ribs of wood V V &c. should

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be placed to guide the ascent and descent of the lifting irons C C; but if these ribs were fixed in the situation shown in plate 6, they would prevent the convenient access to such parts of the apparatus as lie behind them; they are placed, therefore, in four frames U U &c. two of which are shown in section in Plate 7; the sides of these frames are rebated down to fit, and to slide in the grooves in the posts D D; they are retained in their places by small metal pins, which being withdrawn, they slide down and expose the machinery in the upper half of the apparatus. E E &c. are the two top horizontal rails of the same form and size as the lifting shafts B B, but somewhat thicker; F F are rails framed between the posts, and the whole is held together by transverse rails G G, &c. of which, part only are shown in the engravings. H H &c, are four uprights supporting the axles of the tumblers, and I I are four similar uprights supporting two iron wires nearly like the axles of the tumblers, and on which the outer ends of the tumblers rest when not in action. These wires are omitted in the engravings. On the top of the rails F F are placed small friction rollers, two rails having five each, and two having four; on these friction rollers lie the nine *tier shafts* K 1 K 2 &c. The hinder ends of the tier shafts are united together by cords passing round pulleys in the racks L L in such manner that K 1 is connected with K 6; K 2 with K 7; K 3 with K 8, and K 4 with K 9; K 5 has a loaded cord at its hinder extremity passing round the wheel M, and having a constant tendency to draw it backward against the rail N; see an elevation of the pulley and weight in figure 2. The *fore* ends of the shafts K 6, 7, 8 and 9 have similar loaded cords passing round four wheels which keep a continual pull on the respective shafts, tending to draw K 6, 7, 8 and 9 forward, and of conse-

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quence to draw K 1, 2, 3 and 4 backward. Fig. 3 is an elevation of one of the wheels with the cord and weight attached to the fore end of the tier shaft. To each tier shaft except K 5, are hung by cords called *tug cords*, sixteen *tier irons*, P P, &c., and to the shaft K 5 is hung one such tier iron. The situations of the sixty-five tier irons in the left hand half of the apparatus are described in the sectional plan, fig. 3, Plate 6, in which they are seen arranged in rows under the tier shafts, [whose places are indicated by dotted lines. One row of the irons will be seen to be advanced a little to the right hand, and the letters P P &c. referring to that row in the elevation are placed in a line below the other range of letters P P &c. The shape of the tier irons with the hook or catch in their upper ends, and the manner of hanging them to the tier shafts by the tug cords are described in figure 2. Leaving for the present the single tier iron on K 5, out of the question, there are sixty-four in each half of the apparatus to all of which are attached cords 6 6 &c. These cords acting on the harness or leashes by means of the lash 13, 13, separate the warp in sixty-four different proportions at the time the shoot passes through it, and produce a figure equal in length to the space occupied by sixty-four shoots. Here it may be noticed that the machinery for accomplishing this, and which is shown in plates 5, 6, and 7, consists of two parts, precisely similar to each other in their mode of action, and in the nature of their connection with the loom; the only circumstance in which they differ is, that to the left hand half are attached the means for effecting some changes in the internal parts, which changes are transmitted to the right hand half by the connecting cords attached to the tier shafts already described. The internal changes alluded to consist in so altering at certain periods

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the dispositions of particular parts, that in depressing the sixteen treadles four times, sixty-four different tier irons may be lifted. We have already shown that the tier irons are disposed in rows each equal in number to the number of treadles; a reference to figure 2, plate 6, will show how the irons in any one row may all be raised in succession; it will be seen that those attached to K 1, are hanging with their back edges in contact with the lifting irons C C &c., but when the tier shaft is drawn forward as K 3 is described to be, the hooks of the tier irons are brought immediately over the lifting irons, and the latter evidently cannot be lifted without the former, in the manner one of them is shown to be, with its tug cord slackened; the dotted lines in plate 7, describe the positions of the tumblers, lifting shafts, and lifting irons, at each elevation; and the sectional plan fig. 3 plate 6, shows the sixteen tier irons, of the shaft K 3 with their hooks drawn over the lifting irons; it will not therefore be difficult to conceive how each of these sixteen may be lifted in succession by successive depressions of the treadles, nor how the sixteen in the other half of the apparatus, which are suspended from the tier-shaft, in connection with K 3 may also be lifted at the same time, with this consideration that as the motion of K 3 is forward, while that of K 8, in connection with it is backward, the hooks of the tier irons in the two halves of the apparatus will stand in different directions, those in the left hand pointing forward, those in the right, backward. All then that is required is to draw on each pair of tier shafts in succession, and after each of the four pair has been brought into action, and of consequence the figure has been completed, to produce an arrangement which shall suspend the recommencement of the figure, till a length of ribbon determinable at will shall

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have been made plain. For all this it will be seen, that the machinery has resources within itself; in the first place the foremost ends of the tier shafts K 1, 2, 3, 4 and 5, are connected by cords, with the upper ends of five *tier tumblers*, Q 1, 2, 3, 4 and 5, which are hung by their centers on a common axle. A falling flap R swings in two brackets fixed to the posts D D, and by falling retains the upper end of any of the tier tumblers Q which shall have been drawn from under it, as is the case in the engravings with Q 3, in consequence of which the tier shaft K 3 is drawn forward, and K 8 backward, carrying with them the tier irons suspended from them, which are now situated with respect to the lifting irons as has already been explained by figure 2 of plate 6; the quantity of motion given to the tier shafts is more than can be communicated to the tier irons, in consequence of the closeness of the lifting irons, the tug cords therefore are drawn into a sloping direction, which ensures the close contact of the tier irons with the lifting irons, and it is an advantage if the irons be so suspended that on the return of the shaft, the inclination of the tug cords be a little in the other direction, which would equally secure the tier irons from coming into action at improper periods.

Let it be supposed that the weaver beginning to work has drawn on the irons suspended from K 1 and K 6, that they have been all lifted; that those suspended from K 2 and K 7 have also been drawn on, and successively lifted, that now those of K 3 and K 8 are on, and that fifteen of the irons have been lifted, the foremost one only remaining; observe now by reference to plate 6 that the foremost iron of each row, has, besides the cord hanging perpendicularly from it, a second cord which passes under the roller S, and is fastened to

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the lower end of one of the tier tumblers Q; observe farther, by reference to the sectional plan, figure 3, in the same plate that the additional cord attached to the foremost iron of the shaft K 1 is not connected with the tier tumbler Q 1, but with Q 2; the iron of K 2 with Q 3, and so on; when therefore, the foremost iron is lifted, at the same time that it performs its office with respect to the lash and harness, it brings by means of its secondary cord forcing outward the upper end of the tier tumbler, another pair of tier shafts, and two other rows of tier irons into action, the weaver at the next shoot recommencing with the first treadle; K 4 and K 9, may now be supposed in action, and after their irons have been lifted, the foremost one of K 4, will by its secondary cord have drawn on the shaft K 5, whose single iron has no cord acting on the lash or harness, but has one which passes under the roller S, round the two small pulleys T T, and is fastened to the lower end of the tier tumbler Q 1; so long as the shaft K 5 (which having no tier irons may be called a *blank shaft)* is on, the plain part of the ribbon is made by the cords 4 4, which are attached to the lifting irons, and which move, therefore, independently of the tier irons, the lash, or the harness.

Where, however, a plain interval is made between the figures it is generally in satin ribbons, and is produced by means which will be presently described. The cords 4 4, are attached to bundles of leash as the engraving represents them, only when the figure occupies the whole of the middle of the ribbon, and is bounded on each side by straight lines as in the two left hand ribbons; the two right hand ones have distinct figured spots, and are supposed to be satin ribbons. The two sorts, though for the sake of explanation they are in the engraving put into one

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loom are never wove together. The blank shaft would not be required for such ribbons as the two left hand or sarsenet ones; for these it would be required only to attach the cord which passes round the pulleys T T to the fourth tier shaft, which would draw on the first, and re-commence the figure without an interval.

If sixteen shoots of plain, are required between the figures of a satin ribbon, one such shaft as K 5 is wanted, if thirty two shoots of plain are required there must be two such shafts; if there be more than one blank shaft, the second must be brought on by the first, and the third by the second, in the same manner as has been described for those K 1, 2, &c.; and the last only will have a cord passing round the rollers T T; whether, however, there be one or more blank shafts, it will be evident by inspecting the figure and tracing the operation of the cord passing round the rollers T T, that when enough plain ribbon has been made, the tier tumbler Q 1 will be drawn inward at bottom, consequently outward at top, and with it the tier shafts K 1 and K 6, which will recommence the figures. It is, perhaps, scarcely necessary to mention that when one tier tumbler is drawn from under the flap R, that which had previously been out falls back again; to facilitate this, and to prevent the friction of the end of the tumbler against the flap from offering any impediment, the upper ends of the tumblers are made not quite square, and they are capped with a piece of wood, the *grain* lying in a different direction, as shown in fig. 4 of Plate 6. The cord of the tier tumbler in use is always slackened as that of Q 3 is represented in figs. 1 and 3.

Having now given motion to the tier irons, it remains to trace downwards their action on the lash and harness, which will be done with reference to one half of the loom

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only, as both sides are essentially alike. At the lower end of each tier iron is a cord suspended by a hook; there will, therefore, be sixty four of these cords distinguished by the figs. 6, 6, &c. In putting the figure to work, the weaver by reference to the draught or design of the figure, first ascertains how many threads of the warp must be elevated at the first shoot in the figure; he then attaches so many different threads to the cord of the first tier iron; he next proceeds to the second line of the draught, and to the second iron fastens as many threads as are shown to be necessary, and so on till to each tier iron is affixed the requisite number of threads; these threads are called the lash, and are numbered 13, 13 in Plate 4. It was before said that the threads of the harness are so arranged in passing through the leash board 5, 5, that it may be known which fibre of the warp will be lifted by any one of them. The weaver, therefore, having the requisite number of threads to each tier iron, proceeds to connect them with their respective portions of the warp, which causes them to diverge in the manner described in the Plate 4, fig. 1; in fig. 2 it will be seen that they exhibit no divergence of this kind, but descend in four almost straight lines, because the lash of each row of tier irons passes through its appropriated row of holes in the lash board 14, 14; each row of lash is connected with every portion of the harness by slight lines seen between the boards 5, 5 and 14, 14; two such lines are attached to each knot of the lash, and after passing through the board 14, 14 they spread and are united to the two rows of leash.

So far we had traced the operation of the harness upward; if the process be not understood, it will perhaps be rendered intelligible by a brief recapitulation with two or three additional explanatory circumstances. In the first

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place, observe, that the pattern we have supposed to be making is a uniform one; that is to say, it consists of two similar parts which may be divided by a line drawn along the middle of the ribbon, so that when any one portion of the warp is lifted, it is evident that the portion similarly situated in the other half of the ribbon must be lifted also; for which reason there are two rows of holes in the leash board 5, 5; and as one-half of the loom, and of the machinery above, makes two ribbons, through each of these holes pass two threads of leash, making four similar threads in each half of the loom which are lifted at every shoot: supposing, therefore, that there are five threads of lash to be lifted at any one shoot, ten threads of leash would be lifted in each of the two ribbons made by that lash. Let it be recollected that by means of the four slight lines springing from each knot above the leash board 5, 5, either of the four rows of lash above the board 14, 14 can act upon any thread of the harness without interfering with the connexion between that thread and the other three rows. In fig. 5, the part between the two boards is shown separately to explain this; one knot of the threads 13, 13 is raised, lifting with it by means of its two slight lines, the two knots above the lash board 5, while the other six threads proceeding from those two knots become slack, but are tightened again, as soon as the treadle ascends by the weight of the knots 2, 2, suspended from each thread of the harness or leash 1, 1; of these threads, there are as many as there are in the warp, and each has a loop or eye through which one fibre of the warp passes, and by which it is lifted; after passing through the compass board 3, 3, the leash of each ribbon divides into four portions; the outer ones attaching themselves to the cords 4, 4 to form the plain

edges, and the duplicate threads of the middle or figured part separating from each other, and passing through the two rows of holes in the leash board 5, 5. As the leashes of two ribbons pass through one leash board in the manner described, there will of course be two threads in each hole of the board united in the knot above, and as two knots are lifted, four threads of leash will be lifted, by each *(lower)* knot of the lash 13, 13. Of the lash it may be observed, that it is attached to knots both at its upper and lower end; one only of the upper knots as has already been shown, is lifted at a time, but this one by the diverging of the threads will lift several of the lower knots; and farther any one of the lower knots may be, and is lifted by several of the upper knots. The number of the lower knots which will be lifted by any one iron is regulated by the number of diverging threads fastened to the cord suspended from that iron; on reference to fig. 1, Plate 4, it will be seen, that to the first cord are attached two threads; to the second, four; to the third, two; to the fourth, three; which lift respectively eight, sixteen, eight, and twelve threads of warp. These numbers are very much smaller than those which actually occur, but it would have been impossible to exhibit on any moderate scale, every thread and cord used in a machine of this kind, and this circumstance must apologize for several slight liberties which have been taken to reduce the number of lines, and to make their arrangement and connexion more intelligible; in the leash board 5, 5 for example, it will be evident from the description that there should have been as many holes in each of the two rows as there are threads of warp in the width of the figure, but not half of that number are drawn; the lash 13, 13 would consist probably of more than a thousand threads;

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of this number a very small proportion is shown; the cords and lash depending from that row of tier irons which is drawn forward are omitted altogether, because they would appear in the intervals between the other cords and lash and would make the whole a mass of confusion; further it will have been observed that no supports are shown to the lash boards or compass board; these are either carried on slight wooden bearers attached to the framing of the loom or suspended in their places by cords. The four rows of tier irons are kept apart by narrow slips of wood called *guide stripes* running lengthwise from front to back of the apparatus; and the cords hanging from the tier irons pass through holes in boards lying on the rails *a a;* one of these boards is seen in fig. 1, plate 4, but in all the other engravings they are omitted.

There are some parts of the loom, which having no peculiar or immediate connection with the particular invention in question have not yet been alluded to, but which may now be noticed to render the description complete. In the first place, the means for giving a *pearl edge* (as it is called) to the ribbon, which is formed by portions of the shoot projecting various lengths beyond the edge of the ribbon, and those lengths so governed that the projections shall assume a symmetrical appearance, either as *vandykes* or *scallops*, or other more or less regular figures; this effect is produced in the following manner. Ten or twenty horse hairs are laid along each edge of that part of the warp which lies horizontally, and the several hairs pass through leashes in the same manner, so that, if permanently wove in, the edges of the ribbon would differ from the middle by having its warp of hair instead of silk; but the horse hairs (marked *y* in the engraving) are fastened at the hinder ends to the rail O, and consequently

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are drawn out of the ribbon as fast as it is wound on the roller *k*; the hairs are so connected with the leashes, and these again with the machinery above, that in the first shoot, perhaps two hairs on a side are lifted; in the second, four; in the third, six; in the fourth, eight; then six, four, and two successively; after which no hairs are lifted for a few shoots, and the edge is made plain a certain length till the hairs are again acted on. This would produce the simplest sort of pearl edge; but it is necessary to modify this explanation, which for the sake of making it general and intelligible, has been suffered to deviate a little from the fact. Let the two lines *a a*, fig. 5, Plate 6, express the edges of a ribbon, and the lines at right angles the shoot projecting and forming a pearl edge, such as has been described; let the figures signify the number of hairs which were included in the several loops of the shoot to form the pearl edge; it will in the first place be observed, that the shoot must pass from right to left and from left to right to embrace the hairs and to form one loop; and that, therefore, considering but one side of the ribbon, the hairs will require to be acted on only at every second shoot; but it will be further seen that the 8 on one edge is necessarily, not exactly opposite the 8 of the other, but between the 8 and 6 of that other, and that the hairs of one edge will, of consequence, be acted on at one shoot, those of the other at the next, so that an action will take place on the hairs at every shoot, but on one side of the ribbon only; and that action will be alternately on one side and the other. In fig. 2, Plate 4, Z are weights which hang by rings on the hairs and bring them down, after having been raised by the harness to the height shown by the lower dotted lines.

The finished ribbon is not wound immediately on to the

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roller K, but on to a thin iron cylinder longer than the width of the ribbon which nearly fits the roller. This cylinder is rendered necessary, because some one of the ribbons, either in consequence of a different thickness of the shoot or of being struck closer by the reeds in the batten, may probably make faster or slower than the others; and as the motion of the roller is common to them all, and must be adapted to the slowest, some means are necessary for preserving the making part of all the ribbons in nearly a straight line, that each may receive the blow from the reeds in the batten; for this purpose, therefore, the cylinders are used, any one of which can be moved round by hand independently of the others, and each is retained in its place by an iron catch or stub, received into one edge of the cylinder, which has serrated teeth for that purpose.

In the description of the loom hitherto, we have supposed for the most part that a sarsenet ribbon has been making; a satin ribbon is made in a manner somewhat different. The peculiar face of satin is given by keeping seven eighths of the warp *floating*, that is above the *shoot*; if, therefore, satin were made with the face upwards, seven-eighths of the warp must be lifted at every shoot, which would be attended with considerable difficulty and labour; to avoid this, satins whether plain or figured, are made with the face downwards, rendering it necessary, as far as the plain part is concerned, to lift only every eighth thread of the warp at each shoot. The leashes, therefore, through which the warp of a satin ribbon passes, are hung to eight slight wooden laths, called the *satin shafts*, which lie in the loom under, and parallel to, the compass board, as shown in the section fig. 5, Plate 4. Each shaft sustains one-eighth of the whole warp, and in such a loom as we have

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been describing these shafts are attached to the lifting irons C C by the cords 4, 4, which will not in this case be fastened to bundles of leash as the engraving represents them. The connexion of the satin shafts with the lifting irons is such that each rises in succession; and as there are sixteen lifting irons, and eight satin shafts, it is necessary for this purpose, merely to attach the first shaft to the lifting irons 1 and 9, the second to the irons 2 and 10, and so on; thus each shaft would be lifted twice in going through all the treadles; by this means a plain satin ribbon would be made. In order to introduce a figure, and leave a part near each edge plain, threads must be fastened below the satin shafts to such of the leashes as hold the warp which will fall within the figure; these threads are merely a continuation of the leashes, and being united below the shafts any number of the leashes required by the figure can be lifted without lifting the shafts from which they hang; the connexion with the tier irons is made as before described, and in the intervals between the figure, if any occur, the shafts only are in action, and form a plain ribbon.

Although we have drawn and described the making of a pattern containing only sixty-four shoots, ribbons are now frequently made by this machinery having one hundred and sixty shoots in the figure, a height of improvement which a very few years since was not contemplated; and which has raised the manufactures of Coventry to at least a level with those of France. It is almost needless to suggest that as the number of shoots is the product of the number of tier shafts, and of the number of tier irons on each, the length of the figure may be varied at will by altering either of those numbers; but as the number of tier irons on one shaft, is equal to

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the number of treadles, and as sixteen treadles are as many as can be conveniently and effectually worked, as moreover the number sixteen admits most easily of being applied to the eight satin shafts, an increase had better be made by adding to the number of tier shafts, ten of which would give one hundred and sixty shoots, the increased number requiring nothing more for throwing them on in succession, and re-commencing with the first, than an equal number of tier tumblers with an additional one for each blank shaft, with cords and pulleys arranged as has been already described. The leashes in this case, after passing through the leash board 5, 5 would require to be branched out into ten threads to meet the ten rows of lash which would descend from the tier irons.

Beside these facilities of extension, this apparatus possesses several peculiar advantages, among which is the ease with which the whole or any part can be thrown in or out of gear, by means of small cords descending from each of the tier tumblers to within reach of the weaver, by which he can throw on at pleasure any particular part of the figure, and recur to it after a complete disarrangement of the whole machine. Another advantage is, the complete independence of all the different parts which prevents the derangement of one from affecting the rest, and affords opportunity for easy reparation; to which may be added the great simplicity of the parts which being divested of springs, and of every species of delicate machinery are not liable to be easily affected by use violence or dust.

The only objection, if it may be called one, to which this loom is exposed arises from its height, which cannot be much less than eleven feet, and which in some works would require to be thirteen or fourteen. The engraving represents one of a medium height for making four

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ribbons; if eight or ten ribbons are making, the leashes in passing downwards through the leash board *5, 5,* having to spread wider, make a smaller angle, and occasion a great deal of friction and wear in the threads against the edges of the holes in the board; this must be prevented by making the distance between the compass board and leash board as large as possible. If, on the other hand, the figure be very extensive, a greater height is required for the increased quantity of lash, which may be regulated by the holes in the two upper standards *b b.*

The figures in plates 5, 6, and 7, are about one-fifth of the real size.

N° V.

NEW MATERIAL FOR STRAW PLAT.

The Large SILVER MEDAL *and* TWENTY GUINEAS, *were this Session given to Miss* SOPHIA WOODHOUSE *(Mrs.* WELLS*), of Weathersfield, in Connecticut, United States, for a* NEW MATERIAL FOR STRAW PLAT. *Samples of the Grass in its raw, bleached, and manufactured State, have been deposited in the Repository of the Society.*

DURING the late war the importation of hats and similar articles for female wear, manufactured of the fine

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straw grown for this purpose, and known in the market by the name of Leghorn plat, was almost entirely put a stop to. The consequence of this was, an extraordinary degree of encouragement to our domestic manufacture of plaited straw, and a proportional degree of ease and comfort hence derived, by the agricultural labourers of Bedfordshire, Hertfordshire, and Buckinghamshire, by the wives and children of whom this profitable occupation was chiefly engrossed. Competition naturally led to an improvement of the fabric by splitting the straw, which had heretofore been used entire, and by more accurate selection of the straw itself, and more effectual methods of bleaching. At the conclusion, however, of the war, the trade of the country fell into its usual channels, and bonnets and hats of genuine Leghorn plat soon found their way into our markets. The Leghorn straw being much slenderer than that of English growth, may be employed entire for the finest articles, on which account the plat is rendered more even, pliable, and durable, than that of equal fineness made from split straw: it is also greatly superior in colour. A farther advantage is, that the spiral coil of Leghorn plat of which a hat or bonnet is formed, admits of being joined by knitting the adjacent edges together instead of overlapping and sewing them, as must necessarily be the case with the English plat: on account of which difference of construction, the Italian bonnets and hats are of the same uniform thickness, whereas, the English are an unpleasant alternation of ridges and depressions, and require, besides, a considerably greater quantity of plat. These real grounds of preference, independently of the caprice of fashion, soon began to operate unfavourably on the English straw plat, and in a short time put an end to it as far as regards the finer fabrics.

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Another cause also, has operated in producing the present depression of this manufacture, namely, the greater cheapness of labour on the continent in comparison with England. The best Hertfordshire straw may be, and actually is, sent to Switzerland, where it is platted, is then returned to England, paying an import duty of 17 shillings per lb., and may after all, be sold about 25 per cent cheaper than plat made in this country.

Such being the state of things, the Society received with much pleasure a communication from Miss Sophia Woodhouse, the daughter of a farmer residing at Weathersfield, in the State of Connecticut, stating that she had manufactured some bonnets in imitation of Leghorn, from the stems of a species of grass growing spontaneously in that part of the United States, and popularly known by the name of *Ticklemoth*. The communication was accompanied by a bonnet of her manufacture, and a few dried specimens of the entire grass. The bonnet being submitted to the inspection of the principal dealers in such articles, was declared by all of them to be superior even to Leghorn in the fineness of the material and the beauty of its colour; and that the introduction of the straw to this country either by importation or by growing it here, would probably be of public advantage, by supplying a raw material superior to any other, and which probably may be manufactured to great advantage in those parts of Great Britain and Ireland where labour is cheap.

The reward mentioned at the head of this article was, in consequence, voted to Miss Woodhouse, on conditions which should put the Society in possession of some seed of the grass, and also of the process employed by the candidate to bleach the straw. Both these conditions have

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been complied with; the seed received has been distributed during the Summer of the present year to various persons in Great Britain and Ireland, and has germinated very successfully, both under cover and in the open air. In the latter situation it has thrown up a thick mat of long and fine herbage, but has not flowered, it is therefore, probably perennial; and if it endures our Winters, will in all likelihood prove a valuable pasture grass.

The treatment of the stems for the purpose of manufacture, is thus described in the words of Miss Woodhouse herself:—

Weathersfield, Connecticut, December 20th, 1821.

I REGRET that the proper season for cutting the grass had elapsed before I received the communication from London. The small quantity which I had previously gathered, I transmit herewith to the Society. Part of it is prepared for plaiting. It may be considered as a specimen of the usual fineness of the grass, as it has not had a straw, coarse or fine, selected from it.

I am able to give no account of the method of cultivation, having never known it cultivated in this country. It grows spontaneously and abundantly in our meadows. It is more common in fields that have not been highly manured, but that are rather reduced in strength and richness of soil; in a few fields it has been observed, that gypsum and manure have destroyed this grass and introduced clover.

I am able to procure but little of the seed. As it has never been sown in this country, very little of it has been preserved.

I have prepared it for manufacture in the following manner:—I have cut it in the fields from the time of its

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flowering, until the seed is nearly matured; that part only is used, which is between the upper joint and the top or panicle; on this I pour boiling water and then dry it in the Sun; this operation I repeat once or twice, or until the leaves which sheath the stem come off. I then bleach it, but for this purpose I have used no other apparatus than what every farmer's house furnishes. In the first place, I prepare some soap and water, in which I dissolve pearl-ash until it can be tasted; in this solution I moisten the grass, and then set it in an upright position in the bottom of a cask; I then burn brimstone in the cask by means of a small heated kettle or dish of coals, and close the cask at the top with blankets so as to confine the smoke. This fumigation I continue until the grass, moistened by the solution of pearl-ash, &c., becomes dry, which will require about two hours. During this operation, the kettle will generally require to be re-heated, or the coals to be replenished once or twice. The grass is now ready for platting. After this is performed and the bonnet is sewed together, I fumigate it again with brimstone in the same manner as before, being careful to place the bonnet in a situation in which it will be penetrated by the smoke; the bonnet is now finished by pressing, for which purpose, I have used only a common smoothing-iron. The only caution necessary in this operation is, not to have the iron heated so much as to scorch the grass.

SOPHIA WELLS.

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CERTIFICATE.

Hartford County, Connecticut, Weathersfield,
December 27th, A.D. 1821.

PERSONALLY appeared Mrs. Sophia Wells (formerly Miss Sophia Woodhouse), and made solemn oath before me, that she is the inventress of the art of manufacturing hats or bonnets from a certain species of grass, a specimen and description of which accompany this certificate, and the mode of manufacturing is hereto prefixed.

ELIJAH KEACH, *Justice of Peace.*

N° VI.

LEGHORN PLAT.

The Large SILVER MEDAL *was this Session given to Mr.* JOHN PARRY, *Little Mitchell Street, Bartholomew Square,* FOR THE MANUFACTURE OF LEGHORN PLAT FROM STRAW IMPORTED FROM ITALY. *Specimens of the Straw and of the Plat made therefrom, have been placed in the Society's Repository.*

FOR the protection of our domestic manufacture of platted straw, and to encourage at the same time the im-

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portation of the raw material (the Italian straw being much fitter for the purpose than that grown in England), the legislature has imposed the duty of 3*l.* per dozen on imported hats, a lighter duty of 17 shillings a lb. on the plat not made up, and a still smaller one of 5 per cent *ad valorem* on the straw. In consequence of this, Mr. Bigg, a straw manufacturer, imported some time ago a considerable quantity of prepared straw from Leghorn, with a view of attempting its manufacture in this country, but not succeeding to his wish, he placed the straw in the hands of Mr. Parry. Mr. Parry began by acquiring, himself, the art of platting according to the Leghorn method, he then taught it to other persons with such success, that he has now above seventy people, women and children, constantly employed in the manufacture. For these spirited and successful exertions, the Society conferred on Mr. Parry the honorary medal above mentioned, on condition of his disclosing to the Society the particulars of the mode of plaiting according to the Italian method. This they did in order that by giving the same a place in their Transactions, they might communicate them generally to those interested in obtaining employment for the poor in the agricultural districts, by contributing to the revival and improvement of a manufacture at once healthful and domestic, and particularly valuable as accustoming children to habits of industry without the imposition of any hurtful degree of bodily labour.

The following is Mr. Parry's communication:—

Mitchell Street, Bartholomew Square,
March 18th, 1822.

SIR;

AGREEABLY with the conditions of the Society of Arts, as contained in your letter of the 22nd ult., I have

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sent a sample of the Italian straw as imported; and a specimen of the same made into plat in Great Britain. And as a proof that such plat will answer for the same purposes as the foreign productions, I have sent another piece, equally as well *knitted* together, and in the same manner as such articles are made, as are commonly described by "Leghorn hats."

The process is, to cut the ears off the straw with a knife, and to size (sort or select) them as to length and thickness. To cut off a sufficient proportion of the red and white ends, so as to preserve as much as possible, an uniformity of colour. To take thirteen straws and tie them together at one end, then to divide them into a right angle, placing six straws on the left side, and seven on the right. The seventh or outermost on the right, is to be turned down by the finger and thumb of the right hand, and brought up under two straws, over two, and under two, and seven straws will then be placed on the left side of the angle. Then the finger and thumb of the left hand is to turn down the seventh, or outermost straw on the left side, and to bring it up under two straws, over two, and under two, and seven straws will again be placed on the right side of the angle, and so on alternately, doubling and platting the outermost seventh straw from side to side, until it becomes too short to cross over so as to double on the other side of the angle:—then to take another straw, and put it under the short end, at the point of the angle (middle of the plat); and by another straw coming under and over the joined one, from both sides of the angle in the operation of platting, it will become fastened; the short end being then left out underneath the plat, and the newly fastened straw taking its place on that side of the angle to which the short one was directed: and so continue, repeating the

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joining, doubling and platting, until a piece of twenty yards long (more or less), is completed. See fig. 5, Plate XXIV.

The short ends which are left out in the act of joining, are to be cut off with scissors, and the article will be then the same as the specimen herewith sent for the use of the public.

I am, Sir,

A. Aikin, Esq. &c. &c. &c.

Sec. &c. &c. JOHN PARRY.

SUPPLEMENT.

MR. PARRY'S communication relates merely to the manufacture of the straw into plat, but, as the method of knitting or sewing the straw together, according to the Italian mode, is not generally known, the Society instituted an inquiry into this particular.

This part of the business is done principally by Italian jewesses resident in London; and is described in the following figures, Plate XXIV:—

Fig. 5 is a piece of plat of twice the real size, showing the way in which the plat itself is formed.

Fig. 6 represents two portions of plat four times the real size, partly knitted together, showing how the edges of one, fold over the edges of the other, and produce a continuation of the same interrupted line that characterizes the plat itself, so that the junction is imperceptible on either side; the uniting thread being in every part covered by two loops of straw, whereas, at *t* and *v*, it is covered only by a single loop.

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Fig. 7 shows two pieces that are knitted, but have been subsequently drawn a little asunder, in order to show more clearly the passage of the thread. It is first inserted under the straw 1, then under straws 2, 3, 4, &c., till it comes out at the top of 10.

Fig. 8 shows two pieces of plat of the real size, with the needle in the act of passing through the folds in the edge of each piece alternately, as above described. The needle is pushed on through two or three folds at once, till nearly the whole of it is concealed in the folds, it is then drawn through in the manner of a bodkin, leaving its place to be taken by the thread. If the edges are not thrust sufficiently close, the needle will miss some of the folds and the junction though not visibly imperfect is really so. Sometimes, for expedition, only every other fold is threaded, which, however, is an injury to the work, as in this case it requires coarser thread to make the junction secure, and therefore, small elevated lines appear on the surface of the plat, indicating the place of the thread and injuring the evenness of its surface, a defect which detracts from its beauty, and consequently from its value.

Fig. 9 shows the relative position of three loops *x y z* (*x x* being repeated), with the thread passing within them; the loops are really adjacent, but are represented as separated in a direction the contrary of that in fig. 7, for the sake of perspicuity.

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No VII.

FINE BROAD CLOTH FROM NEW SOUTH WALES' WOOL.

The GOLD ISIS MEDAL *was this Session given to Mr.* T. STARKEY, *of Huddersfield, for* A PIECE OF FINE BROAD-CLOTH MADE ENTIRELY OF WOOL FROM NEW SOUTH WALES, *the produce of the Flocks of* J. M'ARTHUR, *Esq. A Specimen of the Cloth is preserved in the Repository of the Society.*

SEE COLONIES AND TRADE, No. I.

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N° VIII.

NEW MATERIAL FOR HATS.

The Thanks of the Society were this Session given to Mr. W. PRITCHARD, *of Castle Street, in the Borough, for the introduction of a* NEW MATERIAL FOR HATS, *instead of Vigonia Wool.*

THE felt of the finer kinds of hats is made of rabbits' hair; but as hair alone will not undergo the process of felting, it is necessary for this purpose to mix with the rabbits' hair, a certain, but small proportion of the finer kinds of wool. That which has upon the whole been in most esteem for this purpose, is the wool of the Vicuña, a species of camel indigenous in Peru and Chili; which is known in commerce by the name of Vigonia wool, or red wool (from the peach-blossom tinge which it naturally possesses). This substance however, is brought here by a long navigation, and is often, from various circumstances, at an extravagant price. In consequence of this, the finer sorts of Merino wool, especially the Saxon, have been employed as a substitute with tolerable success.

The buffalo of Canada is furnished with long coarse hair, intermixed with a certain quantity of extremely fine real wool. The entire fleeces of these animals have long formed an article in the annual sales of the Hudson's Bay

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Company; and Mr. Pritchard was induced at the suggestion of his brother, who had spent some years at Hudson's Bay, to make a trial of it as a substitute for the red wool. The first experiments were sufficiently successful to induce him to form an arrangement with his brother, in consequence of which, the latter returned to Canada, taking with him persons properly qualified to sort and select the wool to answer the expected demand.

Four or five cwt. of buffalo wool so sorted, were imported last year from Hudson's Bay; the quality of which, from the evidence produced before the Committee, appears to be intermediate between that of the real red wool, and the best Saxon Merino wool.

It appears also, that the buffalo wool has of late been very successfully employed in improving the quality of the fine Norwich shawls, and other similar articles.

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COLONIES AND TRADE.

Nos I and II.

FINE WOOL FROM NEW SOUTH WALES.

The Large GOLD MEDAL, *being the Premium offered, was this Session given to* JOHN M'ARTHUR, *Esq. of New South Wales, for importing into London,* 15,130 *lbs. of Fine Wool, the produce of his Flocks in that Colony.*

The Large GOLD MEDAL, *being the premium offered, was this Session given to* JOHN M'ARTHUR, *Esq. of New South Wales, for importing into London, the finest sample of Wool, the produce of his Flocks in that Colony, equal to the best Saxon or Spanish Wool.*

Samples of the Wool have been placed in the Repository of the Society, as well as a piece of Broadcloth manufactured of the same, by MESSRS. STARKEY, BUCKLEY, & CO. *of Huddersfield.*

FOR some years after the establishment of the British colony, at Port Jackson, in New South Wales, the only

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sheep which had been introduced were from Bengal, and the Cape of Good Hope. The fleece of both these breeds was composed of a coarse hairy wool, quite unfit to be manufactured, and which was employed by the settlers, chiefly in mortar for covering ceilings, and the sides of rooms, as the hair of cattle is used in this country. About the year 1795, shortly after the occupation of the Cape of Good Hope by the British forces, three or four pure Merino sheep which had been sent from Spain as a present to the Dutch governor, were transferred from the Cape to Port Jackson, by captain Kent of the Royal Navy. By him they were disposed of to Mr. M'Arthur, at that time a captain in a regiment stationed in the colony, and commanding at Paramatta.

Conceiving the climate of New South Wales admirably adapted to the growth of fine wool, Mr. M'Arthur was induced to pay particular attention to the crossing and increase of this breed of sheep, and their rapid progress fully answered his expectations. In 1804, during a temporary residence in England, some specimens of the Merino wool raised by him, were accidentally seen by a committee of manufacturers of woollen cloth, and, in consequence of a memorial presented by them to government, he was summoned before the privy council, by whom he was examined as to the state of his flocks, and the probability of their further improvement.

Their lordships were satisfied in these points; and thinking it an object of public importance to encourage in a British settlement the growth of fine wool, a regular supply of which was then with difficulty obtained from Spain, they recommended the subject to the attention of the secretary of state for the colonies, by whose directions grants of land were made to Mr. M'Arthur in a part of the settlement well adapted for sheep walks.

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Mr. M'Arthur soon after returned to New South Wales, and carried with him several Spanish rams and ewes of the Escurial or the Negretta breed, purchased from the flocks of his late majesty. His exertions, however, were in a few years impeded by his departure from the colony; and it was not until his return in 1817, after an absence of eight years, that he resumed under his personal inspection, the plans he had originally devised. In this interval, however, the flocks had increased, and had improved upon his estates, and the production of wool soon became an object of interest to the settlers throughout the colony. To encourage this feeling, and to distribute the Merino breed amongst the farmers, Mr. M'Arthur established an annual sale at Paramatta, a town situated on the river which flows into Port Jackson, and about 15 miles from Sydney, the capital. In 1820, three hundred young Merino rams were supplied by this gentleman to government, for the purpose of introducing the same race into the dependent settlements in Van Diemen's Land, where those previously known were chiefly a cross between the Teeswater, and the Cape sheep, and whose wool was of a coarse and unproductive kind. The flocks in New South Wales usually consist of from 3 to 400 individuals, and range over the plains under the care of shepherds and dogs introduced from England and Spain. The principal part of Mr. M'Arthur's are kept upon an estate about 30 miles from Sydney, adjoining the Blue Mountains, where the soil is dry and productive. The foot rot is nearly unknown, and no disease of consequence has been ever prevalent amongst them. Within the last two years, extensive improvements have been carried on to afford the means of extending the flocks, and by increased care and selection of the breeding stock, to bring the fleeces to higher perfection.

It is admitted, that they already excel the parent race in

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Spain, and there is every reason to expect a rapid improvement in the quality and condition of future importations. In the electoral dominions of the king of Saxony (which country is also indebted to Spain for the Merino breed) it is well known that from the coldness of the climate it becomes necessary to keep the flocks under sheds for eight or nine months of the year, during which period they are fed upon dry food, principally bran and hay. In New South Wales, from the mildness of the seasons, which closely resemble those of Madeira, this artificial treatment is unnecessary. The flocks remain in the open air day and night, and do not require the protection of sheds, or to be fed with the same trouble and expense as those of Saxony. The wool from New South Wales, has hitherto been sent to England in fleeces, and unsorted. In this state it is extremely difficult to compare it with Saxon wool, the fleeces of which are divided into five or six parts, forming as many different qualities, and are packed in separate bales. As the number of sheep increase in New South Wales, and experience is acquired, the same mode will probably be adopted there; but, at present, in order to institute an accurate comparison, the process of sorting should be followed. The importation of the present year is expected to be finer and better prepared for the market than any which has been heretofore sent home, and the high prices that have been lately obtained will certainly stimulate the exertions of all who desire to establish a valuable export to the parent country. The importance of it to the colony and to Great Britain may be estimated by considering that about 16 millions of pounds of foreign wool, and 144 millions of pounds of British wool, are annually consumed in our manufactures; that the value of woollens exported is more than 8 millions sterling, and

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the consumption in the United Kingdom is supposed to amount to about 18 millions more; making in all 24 millions sterling per annum.*

For fine wool, Great Britain is now dependent upon Spain, Saxony, and Austria: by promoting its growth in New South Wales, we shall enjoy the advantage of raising in one of our own settlements a most valuable raw material, a portion of which will always be returned to the colony for consumption in its manufactured and ornamental state; thus establishing an intercourse beneficial to the grower, to the ship owner, and to the manufacturer at home. The extent of fine country already discovered in New South Wales, in length about 250 miles, and in breadth about 200 miles, affords pasturage of the best description.

It is probable that no better proof can be offered of the value of New South Wales' wool, than by inspecting the cloth sent to the Society by Messrs. Starkey, Buckley, & Co., who concur with other manufacturers in their testimony of its good qualities.† As a considerable quantity of olive oil is required in the manufacture of fine cloth, Mr.

* See Evidence before the Lords of Trade, page 2, and Returns to the House of Commons—Session 1821.

† The cloth above-mentioned, for which the Society bestowed on the manufacturers the Gold Isis Medal, was a piece of superfine blue of the ordinary width, made entirely from fine New South Wales' wool, purchased at the public sale of the same, in the year 1821. Mr. Starkey states that, independently of the fineness of fibre, the New South Wales' wool has the quality of being uncommonly soft to the touch, like fur; and hence, may be very advantageously used to mingle with Spanish and German wool of equal fineness; and thus, to correct a certain harshness, which even the very highest numbers of European wool are apt to possess, and which is very striking on comparison with the extreme softness of that from New South Wales.

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M'Arthur has, amongst other exertions for his own benefit, and for that of the colony, introduced olive trees into New South Wales, and by late accounts, it appears that they flourish well, and have already produced some fruit, from which a small quantity of fine oil had been extracted by way of experiment.

The freight of wool from New South Wales is 3*d.* per *lb.* The duty 1*d.* per *lb.*

Mr. M'Arthur's wool was sent to the Society in the state in which it is imported, that is, in the entire fleece; but from the high character given of it by the principal wool-brokers of London, it appeared very desirable to have a quantity stapled or sorted. With this view, a bag was sent to Mr. Swaine, of the house of Swaine and Co., through which most of the Saxon wool is imported to this country. The sorting was performed by Mr. S. himself into four qualities, the three first of which were submitted to the examination of various persons skilled in the article. The finest, or No. 1, was pronounced by Mr. Swaine to be equal to the best quality of Saxon wool imported. The Saxon fleeces yield on an average about one-tenth of No. 1 wool, but those from New South Wales afford rather a smaller proportion.

The subjoined testimonials from Mr. Nowlan and from Messrs. Marsh and Ebsworth, preclude the necessity of saying any thing more on the subject.

18, St. James's Street,
16th March, 1822.

SIR;

In compliance with your request, I have attentively examined the three samples of wool which you exhibited to me at the Society's house, the growth of New South Wales, and as far as the experience of twelve years

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during which I have been connected with the manufacture of superfine cloth qualifies me to judge, I am of opinion that the first quality is superior to the best Spanish, and equal to the best Saxon wool imported into this country; the 2nd and 3rd sorts are excellent of their kind, and in good condition.

I have the honor to be, Sir,

A. Aikin, Esq. T. NOWLAN.
Sec. &c. &c.

66, Coleman Street,
18th March, 1822.

SIR;

WE carefully examined the three samples of assorted New South Wales' wool which you left with us a few days since, and beg leave to state our opinion of their quality and value.

No. 1 is quite equal to the average quality of Saxon wool, denominated *Electoral*, and which has sold in this market during the last 12 months from 8 to 9*s.* per *lb.*

No. 2, equal to the average Saxon wools, denominated prime, and sold from 6*s.* 6*d.* to 7*s.* 6*d.* per *lb.*

No. 3, equal to the average Saxon wools, denominated seconds, and sold from 4*s.* 9*d.* to 5*s.* 9*d.* per *lb.*

Some few bales of Saxon wool have sold as high as 10*s.* 6*d.* per *lb.*, but the quantity has been inconsiderable and selected from a large number of flocks.

We are, respectfully, Sir,

John M'Arthur, Esq.
&c. &c. &c. MARSH & EBSWORTH, Brokers.

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N° III.

WOOL FROM VAN DIEMEN'S LAND.

The CERES SILVER MEDAL *was this Session given to* JOHN RAINE, *Esq., of Great Coram Street, London, for his exertions in opening a Market for the* WOOL OF VAN DIEMEN'S LAND, *and in taking measures for Improving its Quality.*

THE settlement of Van Diemen's land is a dependency of the colony of New South Wales. In the year 1820, Mr. Raine arrived there on commercial business, bringing with him twenty Merino rams for sale; he also made considerable purchases of the best wool at that time grown there, and brought to England 61 bales, weighing 17,606*lbs.* A sample was sent to the Society for examination, and in claim of the premium offered to the person who shall have imported the greatest quailty of fine wool, the produce of New South Wales. On investigating the subject, it appeared that Mr. Raine's wool was not of the quality known in the market by the name of fine wool, its value in the entire fleece being less than 2*s.* 6*d.* per *lb.*

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The Society, however, to mark their approbation of the exertions of Mr. Raine to benefit the settlement by the introduction of Merino rams, have thought proper to present him with the Silver Ceres Medal.

N° IV.

SEA ELEPHANT OIL, FROM NEW SOUTH WALES.

The Large SILVER MEDAL *was this Session given to* JOHN RAINE, *Esq., of Great Coram Street, London, for importing* 400 *Tons of* SEA ELEPHANT OIL, PROCURED WITHIN THE LIMITS OF THE COLONY OF NEW SOUTH WALES. *A Specimen of the Oil has been placed in the Society's Repository.*

A GROUP of small islands, named Macquarrie's Islands, has recently been discovered to the South of Van Diemen's land. Thither Mr. Raine dispatched a ship properly equipped for the purpose of taking sea elephants, a large species of seal; he had the good fortune to procure in six months as many of these animals as furnished 400 tons of oil. The oil on examination, both with regard to its capability of burning in

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a lamp and of furnishing oil gas, appeared to be of about the same quality as good Southern whale oil. The Society in consequence of the addition thus made to the articles of export from the Colony of New South Wales, which at the same time multiplies the resources of the parent country in case of a scarcity of oil from other quarters, have given to Mr. Raine their large Silver Medal.

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APPENDIX.

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APPENDIX.

N° I.

The Thanks of the Society were given this Session to GEORGE WEBB DE RENZY, *Esq., Captain in the 92nd Regt., for his offer of the* WOOD BLOCKS REPRESENTING VARIOUS ARTICLES OF AN APPARATUS INVENTED AND ADOPTED BY HIM FOR THE USE OF THOSE WHO HAVE LOST A HAND. *A set of the Apparatus has been placed in the Repository of the Society.*

IMPRESSIONS from these blocks were published by Captain De Renzy last year, in a small work on the subject, entitled "Enchiridion, or a Hand for the One-handed;" but the circulation of this work being necessarily restricted within narrow limits, the Society have been induced to vary from their usual practice of not re-publishing what has already been printed, by the ingenuity and simplicity of the apparatus. They have, farther, been influenced by an earnest desire of contributing as far as lies in their power, to the comfort of per-

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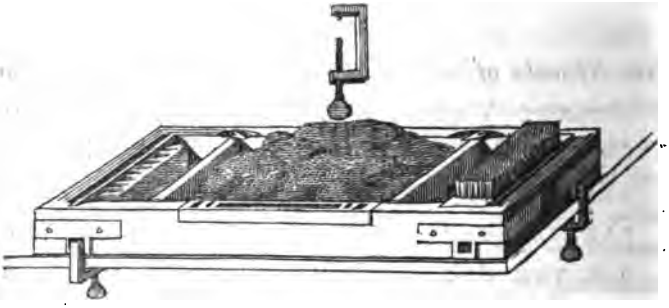
sons thus unfortunately circumstanced, by pointing out to them the means of emancipating themselves from that constant dependence on others for the performance of offices trivial in appearance but important from their constant recurrence which constitutes the peculiar aggravation of the loss in question.

The Society have not thought it necessary to avail themselves of Captain De Renzy's liberality to its full extent, but have contented themselves with selecting such articles as appear most important, either from their use or from the ingenuity of their construction.



The Wash-Hand Tray Complete.

This is the largest article belonging to the one-handed apparatus: it is nevertheless sufficiently portable to be carried in a small travelling bag; as it is only a foot in length, five inches in width, and one and a half in depth. It is made of mahogany, bound with brass; and is lined with tin-foil, or lead paper, to secure it from the moisture of the sponge which occupies the middle of it, as is seen in the engraving; on each side of the sponge is a nail brush, the position of which can be changed in a moment, as may be most convenient to apply

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the hand to them. The sponge is fastened down by two pieces of bone or ivory, which pass transversely from one side of the tray to the other, at each end of the sponge, making the middle of it firm to rub the hand upon. On one side of the tray a space is left for the reception of a nail-file, which shall be described in due course; it can be fastened in an instant into the place allotted for it; and enables a one-handed person to clean, pare, and file his nails, with the utmost facility. The tray itself is attached to the dressing table by a pair of small plated clamps, which are represented in the engraving, and are too simple to require any further explanation. By means of a tray thus fitted up, it will be evident that a person who has either lost one hand entirely, or the use of it for a time, will be able to wash that which remains, far better than any other person could do it for him: and the comfort and independence which I daily experience from the use of it, are such, that I cannot refrain from advising every one who may be similarly situated with myself, to lose no time in providing himself with this desirable auxiliary of cleanliness. My constant use of it has enabled me to make many improvements on the original invention, and I trust it will now be found one of the most convenient, as well as ornamental appendages that has ever been offered for the dressing room of any person who may require artificial aid.

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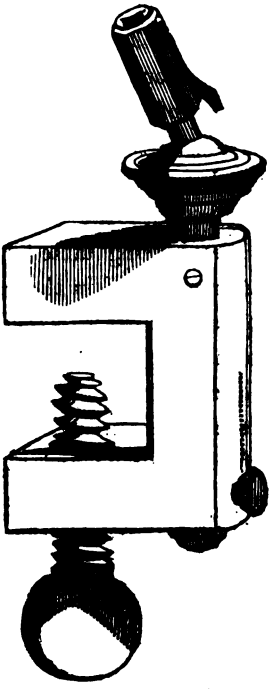

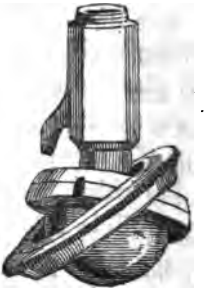

The second article, which I will describe, is an Ivory Vice of the common kind, only somewhat more than usually substantial. It will be found extremely useful, on account of the number of purposes to which it may be applied; such, for instance, as holding a razor strop steady; or a letter firm, when it is to be sealed; or paper for the purpose of writing or drawing upon; as in all these respects it answers the purpose of a lead or marble slab: but it becomes of far more important use when the universal joint, or ball and socket is attached to it; there is then scarcely any part of the day in which its utility is not called into action in some way or other. If I wish to

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to cut my nails, it holds my knife firm for the purpose; if to make a pen, or point a pencil, it receives my quill-holder, or pen-nibber; at breakfast it enables me to eat an egg with comfort, by holding an egg-cup in any direction I wish; by fixing my hat-stick in it, I can brush or sponge a hat with as much ease as any two-handed valet could do it for me; and if I wish to conclude the evening with a rubber at whist, the vice, along with the ball and socket, enables me to place my card-holder in such a manner as to enable me to play my cards with as much celerity as my partner, however impatient he may chance to be, can possibly desire. The principle of the ball and socket is so generally known, and so fully appreciated in mechanics, that it is unnecessary for me to enter into any elucidation of it in this place; as the accompanying engraving will be found to exemplify it quite sufficiently for my present purpose; but I cannot conclude my remarks on it without observing that its exceeding utility to a one-handed person is such, that it may be justly termed the main-spring of the one-handed apparatus; particularly as the various instruments which it may be requisite to fix in the stem, are so contrived that they may be put in, or taken out, in an instant; simply by pressing the thumb lightly on the outside of the spring, holding at the same time in the fingers the article intended to be removed. The spring itself is similar to those which trepanning instruments are generally applied to: for this most useful addition of the ball and socket to the vice, I am indebted to Mr. Oldham of the Bank of Ireland; a gentleman distinguished for science and ingenuity. He suggested it to me shortly after my return from Spain, for the purpose of enabling me to make a pen, and I have since from time to time made additions to it, which have rendered it much more extensively useful.

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A Lather Box is the third article which I shall beg leave to mention; though I am aware it is by no means indispensably necessary to the operation of shaving; which indeed those who are *tender visaged* may perhaps be enabled to perform with somewhat more of ease to themselves, by making the lather on their own chins, rather than within the box; but to those who have firmness enough of nerve, or cuticle, to bear the closest contact of the razor, I recommend the lather box, as much more cleanly and comfortable. It must have a joint fixed in the bottom of it, as is represented in the engraving, and that joint should be made to fit the stem of the ball and socket belonging to the ivory vice, by means of which it may be attached to the dressing table, and removed at pleasure.

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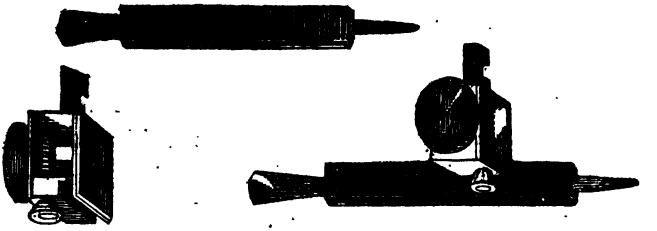
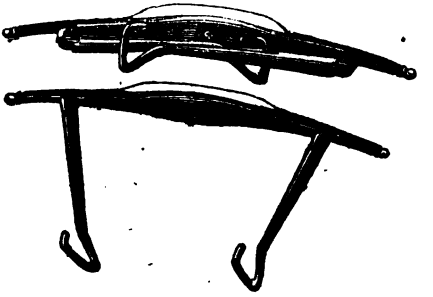


This Nail File will be found particularly useful; as the ease with which it can be applied, in an instant, by means of the small brass vice that accompanies it, as represented in the engraving, to the edge of the wash-hand tray, or to a table, will always enable a gentleman to shape his nails and keep them clean; should any accidental circumstance oblige him to have recourse to it in the middle of the day, it will be found to take up very little room in the waistcoat pocket, if put into a case to guard against the possibility of injury. The brass vice is made to fit into the stem of the universal joint, before described; by which means the file can be turned in any direction which may be deemed most convenient.



By means of the Boot Hooks represented in this engraving, a one-handed person may be enabled to draw on his boots with

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more expedition than any attendant could do it for him. They are in every respect as portable and as convenient as those in common use; and though from the simplicity of their construction no other description of them is requisite than that which the engraving itself conveys, yet I deem it necessary to point out the utility of them, because, notwithstanding their simplicity, and the great convenience resulting from the possession of them, I find that they are by no means so well known as they ought to be, among those to whom their assistance would be most useful. A slight improvement has been made on the original invention, by making the bar which is held in the middle by the hand, somewhat stouter, so as not to hurt the fingers in drawing on the boots, if damp, or more than ordinarily tight.

Having now gone through the operations of the toilette, I shall beg leave to conduct my readers into the breakfast parlour; where we will imagine the table properly furnished for that most social of all meals, and among other articles of refreshment, with eggs; a species of food to which travellers, and military men in particular, are so often indebted for allaying the feelings of hunger, when no other can be procured, that they naturally regard them with partiality. For my own part I

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have almost as great a reverence for an egg, as those ancient philosophers professed, who believed that the world itself came out of one. Few persons reflect on the wisdom of Columbus, by which he was led on to the discovery of another hemisphere, without associating it in their minds with the well known story of his acuteness in challenging the nobles around him to make an egg stand perpendicularly on the table. Until I supplied myself with an egg cup to my mind, I often wished that he had rather taught the art of eating it with one hand; as I continually found half of this desirable *morceau* elude all my endeavours to secure it with the spoon, owing to its turning round in the common egg-cups, and wanting altogether the firmness, and occasionally inclined position, necessary to allow of the shell being completely emptied.

The egg-cup represented in the engraving is of silver, but plated ones look extremely handsome, and are of course more moderate in price. It is applied to the stem of the ball and socket, which is then fastened to the breakfast table, and allows the egg-cup to be inclined in any direction; the upper part of the egg-cup takes off, to admit of the egg being put in, and then being fastened on again, it keeps the egg stationary, having an orifice at the top sufficiently large to admit the spoon.

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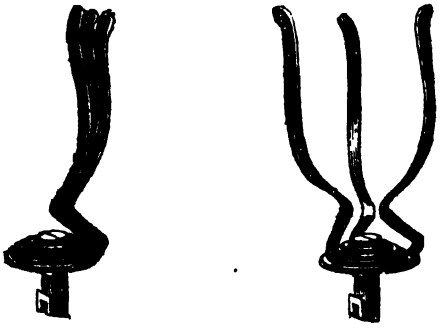
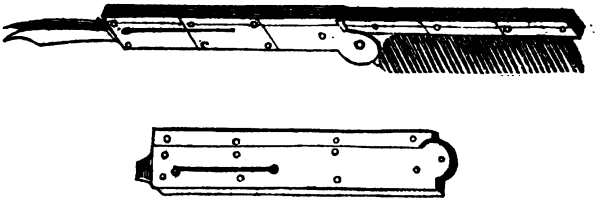


A more portable and less costly Egg Holder is represented in this plate. It is made of steel; attaches to the ball and socket, when wanted, and when not in use, folds into so small a compass as peculiarly to fit it for the pocket of a traveller, under the circumstances of those to whom I am addressing myself.



We will now dismiss the eggs, and with them the breakfast-table altogether: proceeding to the more serious avocations of the day, we naturally turn towards the writing-desk; and here I hope I shall be enabled to do away some of the many

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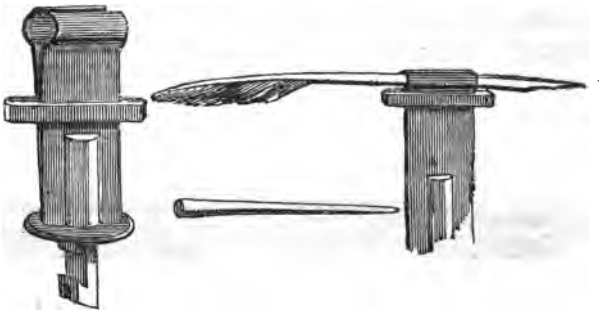
inconveniences resulting from his loss, which to a one-handed person renders tedious and mortifying, what is to others the most delightful of all occupations, that is, maintaining an intercourse with our friends, by epistolary communication, when deprived of the personal enjoyment of their society. The Pen-knife represented in the engraving is furnished with a spring, by applying the thumb-nail to which the blade slides in and out with ease; which renders it safer for a one-handed person than those commonly in use. It will likewise be found convenient in the pocket, as containing a comb, and a turn-screw; and being marked on the outside at regular intervals, it will, when open, serve as a scale or measure of six inches in length.



The Quill-holder is a very simple instrument, by applying which to the stem of the universal joint, and ivory vice, and fastening the whole to the table, a pen may be made or mended, and a pencil pointed by only one hand, with as much ease and expedition, as if two were employed in doing it. The instrument must be placed on the defective side; so as to make the table a support for the arm. By putting a small tapered piece of ivory, or quill, into the pen, similar to that

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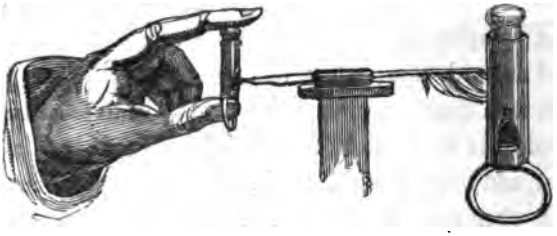
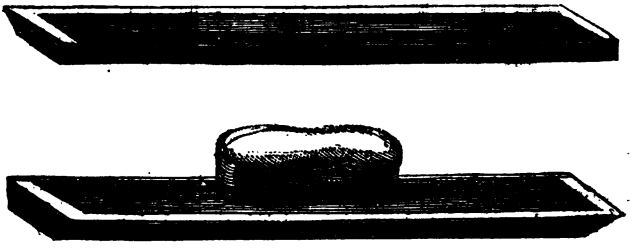
which is represented in the engraving, the pen may be nibbed very well with one hand. This operation, however, may be performed still more accurately by the



Pen-nibber here represented, and which will be found as useful for persons of imperfect sight as for the one-handed. The nib of the pen is formed in a moment by placing it under the chisel, which is then pressed quickly upon it.



Having provided for the pens and pencils, a Ruler is the next object of consideration—this in the engraving above differs no way from that in common use, excepting in being

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made considerably heavier, in order to enable it to resist the pressure made against it, in drawing lines, and likewise to keep the paper steady; which will be still better done by placing the leaden cushion already mentioned upon it, and it may likewise be made useful in keeping open the leaves of a book.

This engraving represents a Steel Vice, which will be found serviceable on many occasions; particularly to those who are fond of mechanical pursuits. It can be applied to the ivory vice at the underpart, or screw end, where there is a small brass socket to receive it, and which should be placed uppermost, when this article is made use of; it is secured yet more firmly by a little thumb-screw, which is represented in the engraving of the Ivory Vice.

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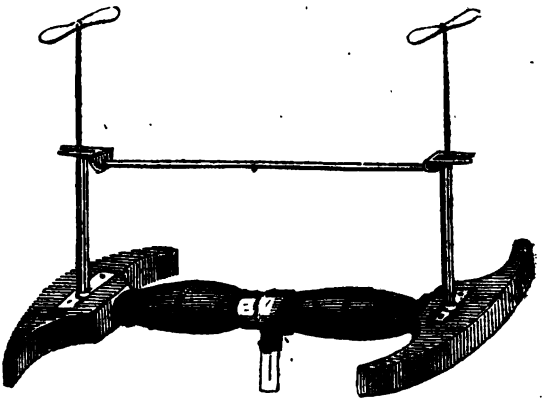

We will now presume the business of the morning within doors to be transacted, and that engagements abroad ensue. For this purpose we will suppose the hat requires brushing; an operation not very easy to perform with one hand alone; but with the assistance of the Hat Stick represented in the engraving above, it will be done with the utmost facility. In the center of this hat stick or stretcher is a joint which fits into the screw-end, which in this case is placed uppermost, of the ivory vice, and it is thus fastened to the edge of a table. The small brass socket and thumb screw, mentioned in the preceding article, hold it sufficiently steady for the purpose. The supporters which screw into the hat-stick on each side, are for the hat to rest on, and the cross bar is to keep them in their proper situation. When the hat is placed on these supporters, the stretcher can be lengthened or shortened, by one hand without any difficulty; accordingly as it may be required. In case of getting wet, it will be found equally conducive to economy and comfort, to be enabled by this simple contrivance to sponge a hat, or rub it dry, without being obliged to wait for the assistance of another person.

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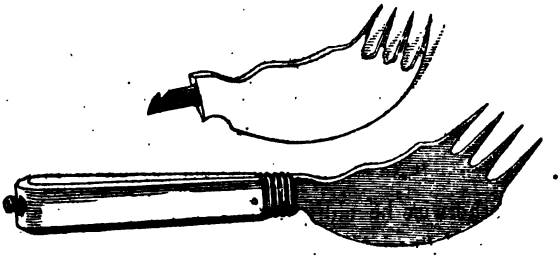

We will now turn our attention to the dinner table, a scene of action at which I believe most of my readers will agree with me, it is particularly desirable that every one should be able to shift for himself: and here I flatter myself that I shall be enabled to render an essential service to the one-handed by drawing their attention to the most perfect Knife and Fork which has ever been offered to the notice of persons so circumstanced. It will be seen by the engraving that the knife and fork form but one instrument: the knife is curved in the form of a cheese-cutter, and terminates in four prongs, which act as a fork; it cuts by pressure, and as quickly as any other knife can accomplish, or as the most active *gourmand* can desire.

Three blades form a set. They are curved according to the hand for which they may be required; and the fork of one of them is plated so as to answer the purposes of a silver one.

They are all made to fit the same handle, within which is a spring to hold them tight; and they can be changed with the utmost facility, by slightly pressing on the table the end of the handle where the spring projects a little, holding at the same time the blade which is to be removed between the fore-finger

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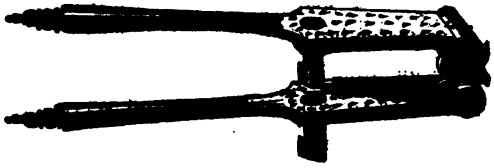
and thumb, in order to prevent its falling out upon the table-cloth.

For portability the handle and blades have a small red morocco case, which opens by the slight pressure of a spring and thus a person who has only the use of one hand, may sit down in any company with as much ease and independence as the rest of the guests,

"No fear lest dinner cool."

who would otherwise be obliged to tax the politeness of his next neighbour for assistance.



The dinner being thus provided for, we proceed to the dessert; in which there are few articles more favourable to the prolongation of social intercourse than nuts. In one respect however nuts are like jokes; to make them wholesome, and palatable, every man should crack his own. To facilitate this operation for a one-handed person, there is only to add to a pair of the nut-crackers in common use, a pivot such as is represented in the engraving, whereby it may be attached to the ball and socket, when fastened to the edge of the table; and thus it is rendered firm, and convenient to the hand.

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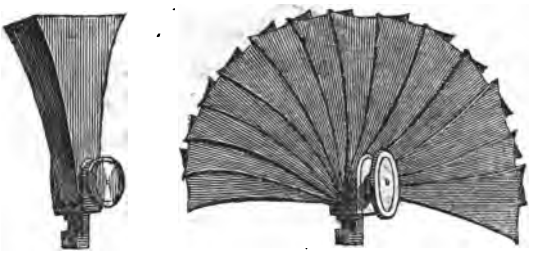

Leaving the dining-room we proceed to the drawing-room, where a social rubber at whist may be occasionally resorted to, by way of varying the amusements of the evening. Here the card-holder above represented will be found as useful as it is simple and portable. It consists of fourteen slips of silver or steel, which fold up, and open out like a fan. It is fastened to the table by means of the ball and socket so often mentioned, because so often useful; and will be found to possess in perfection one quality very requisite in the game of whist, and that is of holding the cards in such a manner that they are not liable to be seen by any of the party, excepting the person to whom they belong.

For the original idea of this little instrument I am indebted to Mr. Caslon in Burton Crescent; in the course of using it I have made a few improvements, which have rendered it complete, as far as I can discover. Those who wish to possess one of a similar kind must be particular in giving directions that it should be made exactly like that which is represented in the engraving; as unless the slips of silver or steel be broader on the top than the bottom, they will not hold the cards properly.

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The representation given in this engraving of a Watch wound up by only one hand, is likewise so explanatory, that it is scarcely necessary to say any thing in addition to it. I will, however, remark, that it is done by taking hold of the handle of the watch with the two middle fingers; the key is then taken up by the forefinger and thumb, which place it in the key-hole, and turn it without any trouble. A hunting watch, or one with the key-hole in the dial-plate, is not well adapted for a one-handed person, as the interference of the crystal renders it tedious, and difficult to turn the key.

And now having wound up the watch, which is generally the concluding operation of the day, I may be fairly allowed to wind up my subject, and to take leave of my readers with the agreeable hope that some of them, at least, will find themselves benefitted by those suggestions which I have thrown out for their service; and which are the result of my own personal experience of the advantage to be gained from them with regard to the three great requisites to the comfort of most persons, but to none more than to military men; which are, Cleanliness, Economy, and, above all, Independence.

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N° II.

MR. ROTCH'S ARCOGRAPH.

The following Explanation of the Graduated Arc attached to this Instrument, was omitted in the XXXIX*th Volume of the Society's Transactions.*

By referring to the engraving of the instrument in Plate I. of that Volume, it will be observed, that the graduated quadrant is divided into 180 equal parts, so that the mark *c*, on the fiducial edge of the quadrant *c d e*, which mark is 90 degrees from the extremity *e*, indicates a quantity which is always double the difference between the angle formed by the limbs and 180 degrees. Thus when the limbs are at 90° the point *c* marks 180 or $2 \times \overline{180-90}$; when the limbs are in a straight line, or at 180° the point *c* marks 0, or $2 \times \overline{180-180}$. Let it be supposed that the instrument is describing the arc *a b c* (plate XXIV. of this volume), then *d b* and *b e*, are the limbs of the instrument opened to the angle *d b e* or *a b c*; let the circle be completed, and *f* be the centre, draw the lines *a f* and *c f*, and also the lines *a g*, *c g*, then, by the 22nd of the first book of Euclid $\angle a b c, + \angle a g c = 180°$, therefore $\angle a g c, = 180° - \angle a b c$, but the angle *a f c*

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is the quantity contained in the arc $a\ b\ c$, and by the 20th of Euclid $\angle\ a\ f\ c$ = twice $\angle\ a\ g\ c$;
but $\angle\ a\ g\ c = 180 - \angle\ a\ b\ c \therefore \angle\ a\ f\ c =$ twice $180 - \angle\ a\ b\ c$ and $a\ b\ c$ is the angle formed by the limbs, therefore, the quadrant being graduated so as to indicate double the difference between the angle of the limbs and 180 degrees, will express the quantity of the arc described by the instrument.

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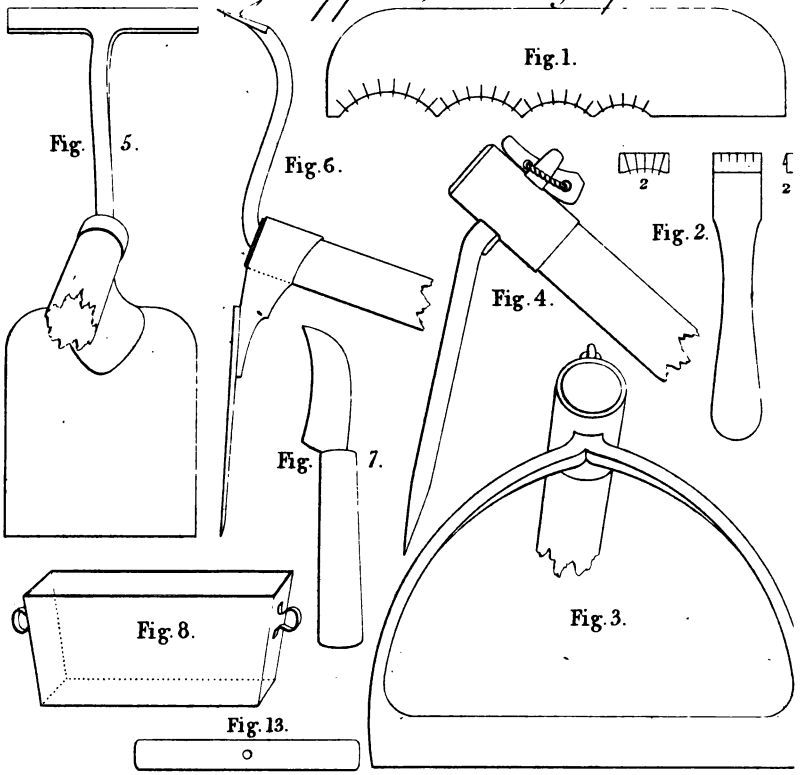

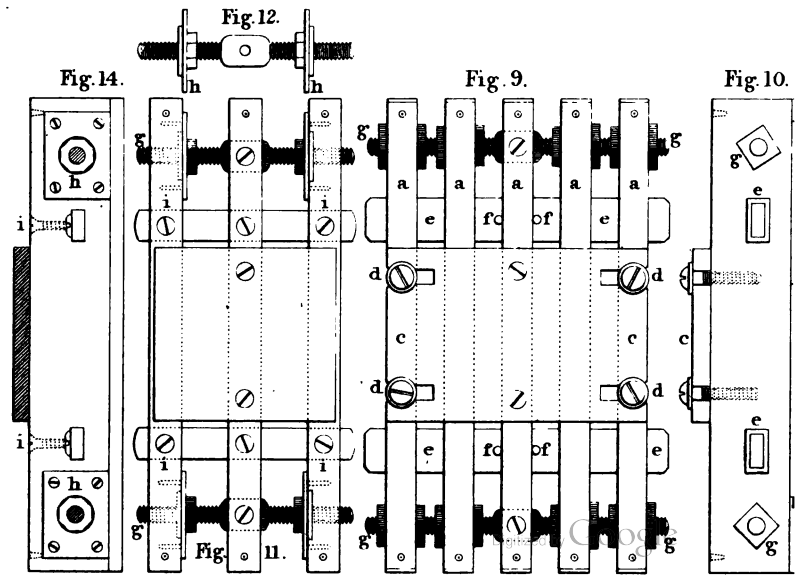

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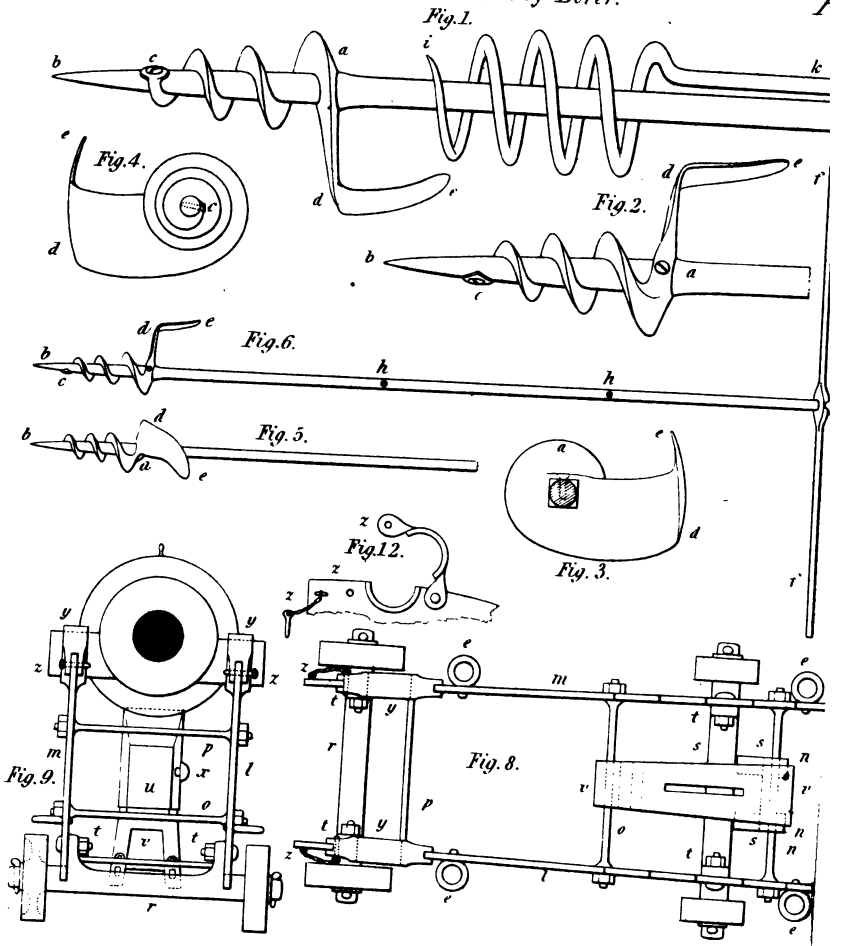

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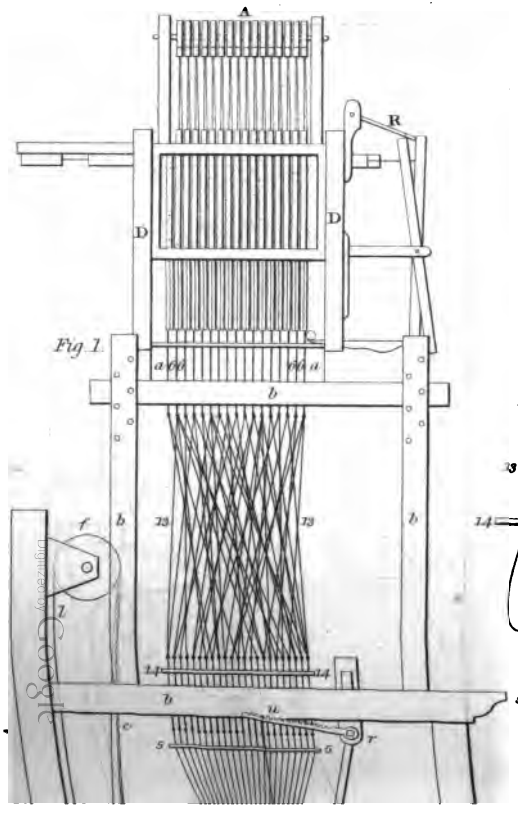

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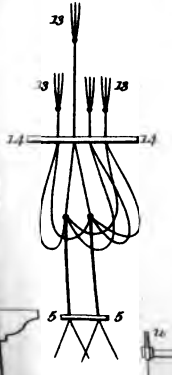

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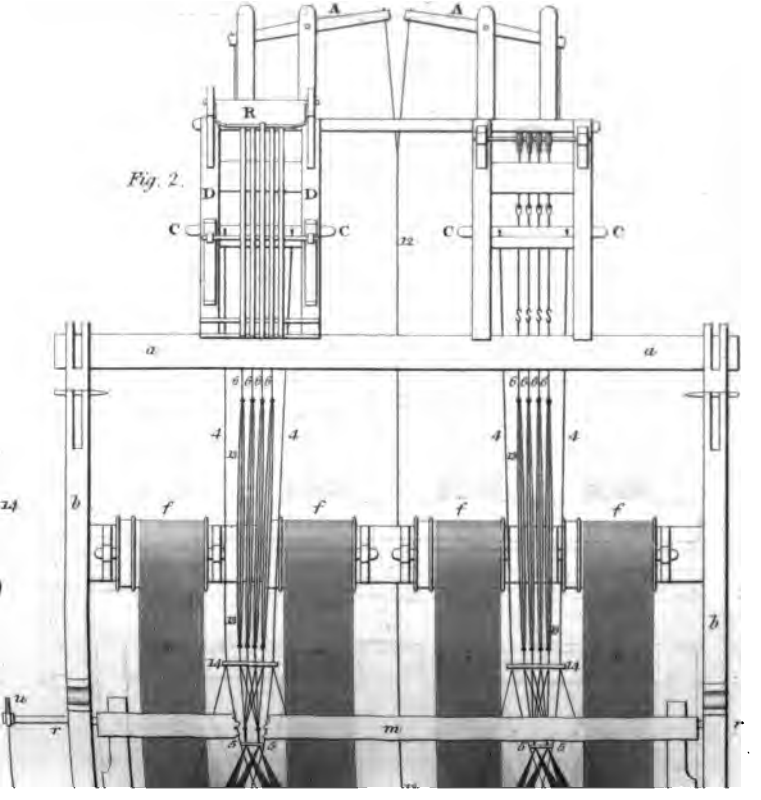

Fig. 2.

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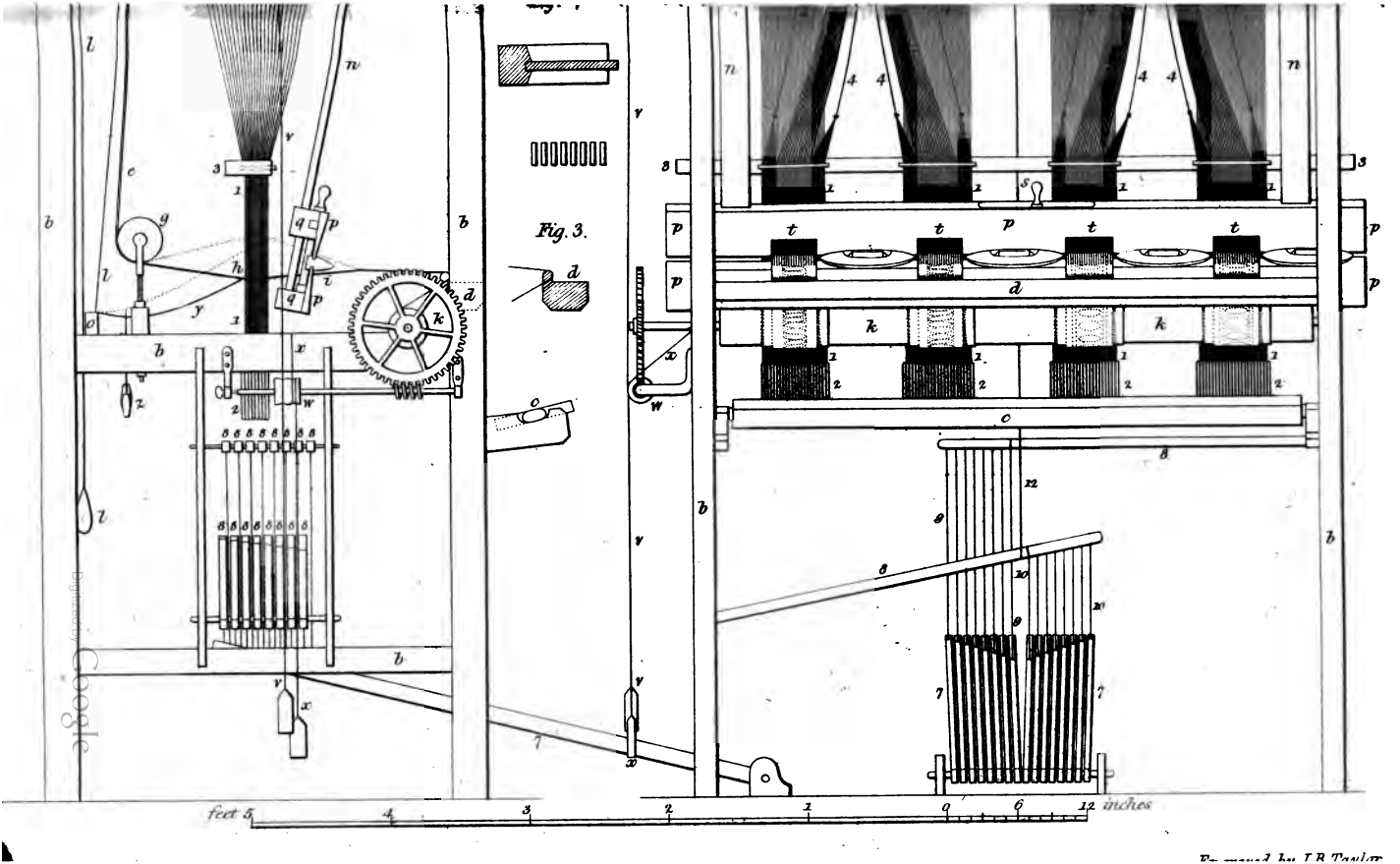

Engraved by J.B. Taylor

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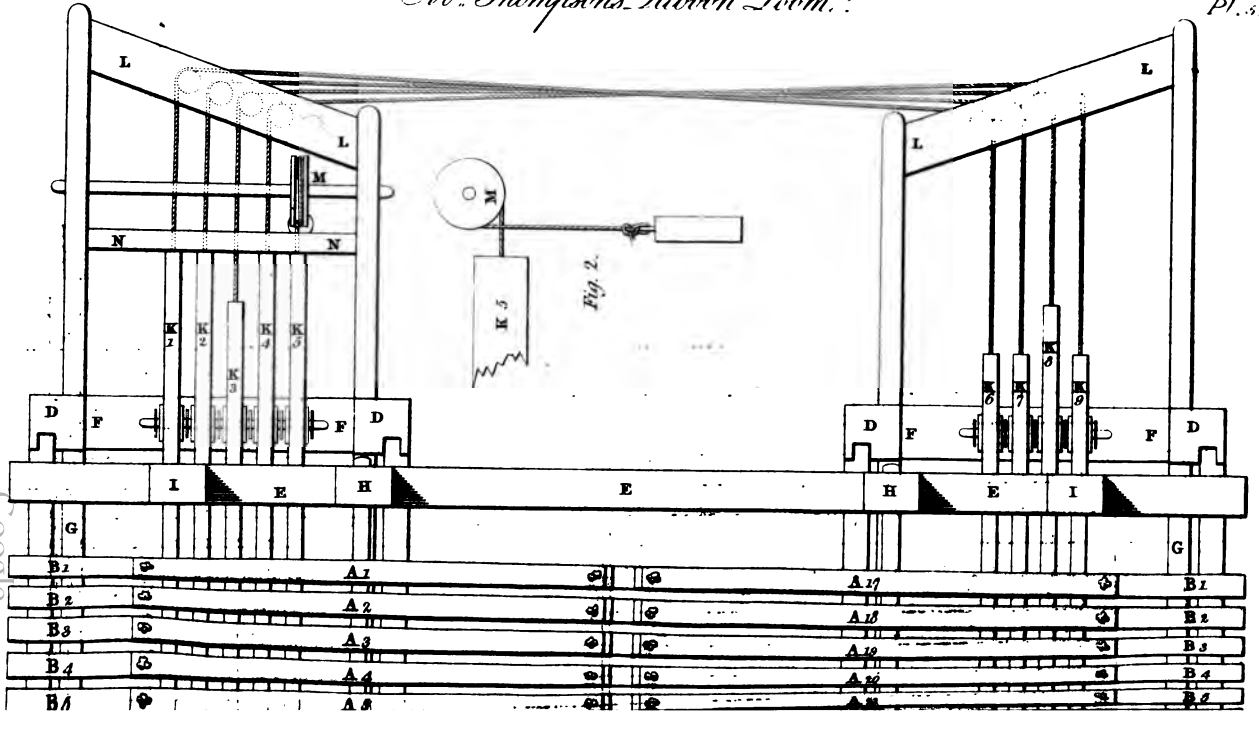
Mr. Thompson's Ribbon Loom.

Pl. 5.



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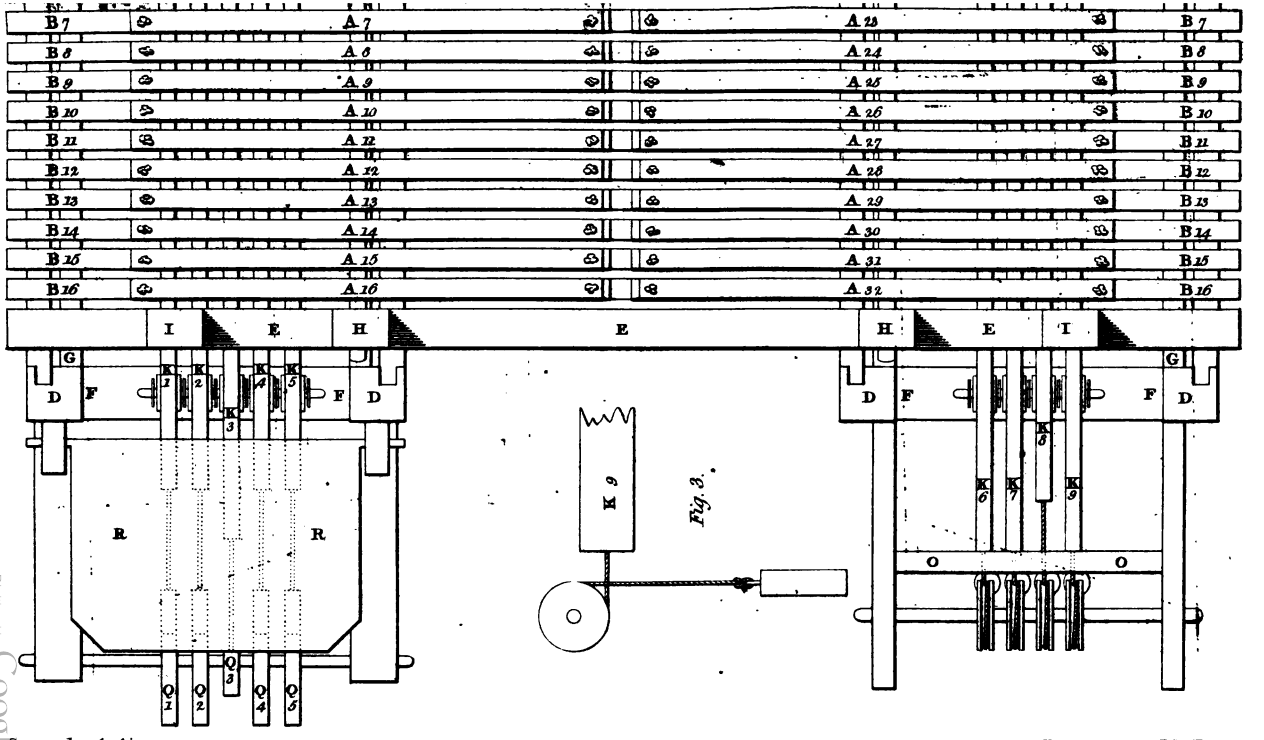

Drawn by A. Ainger.

Engraved by J.B. Taylor.

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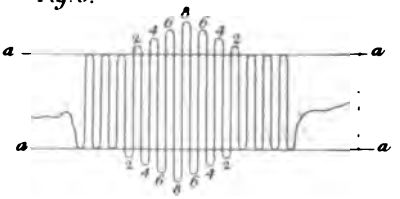
Mr. Thompson

Fig. 5.



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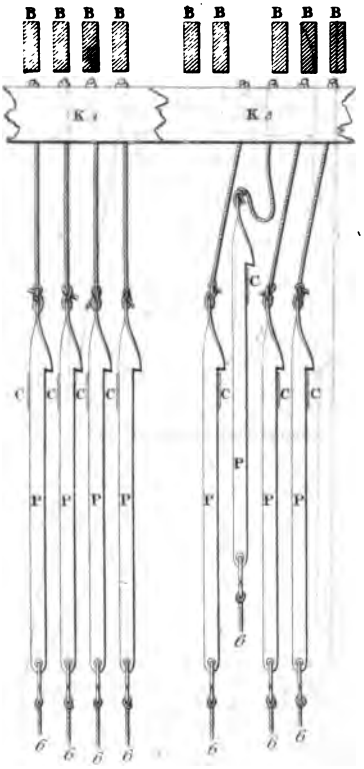
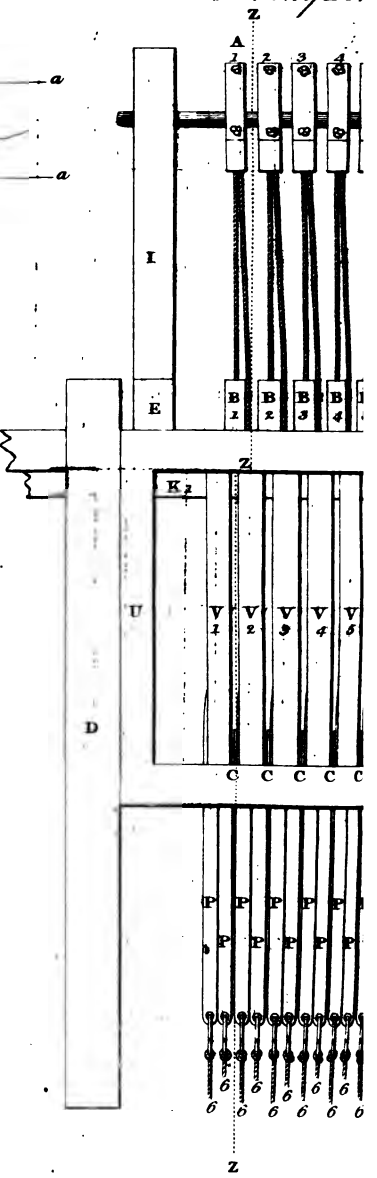




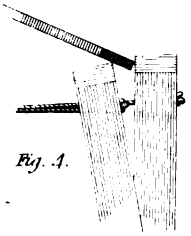
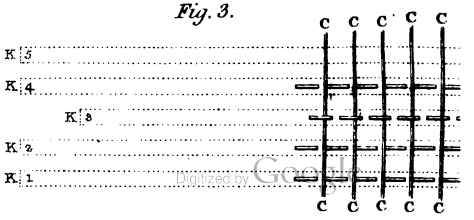


Fig. 4.

Fig. 3.



Drawn by A. Ainger.

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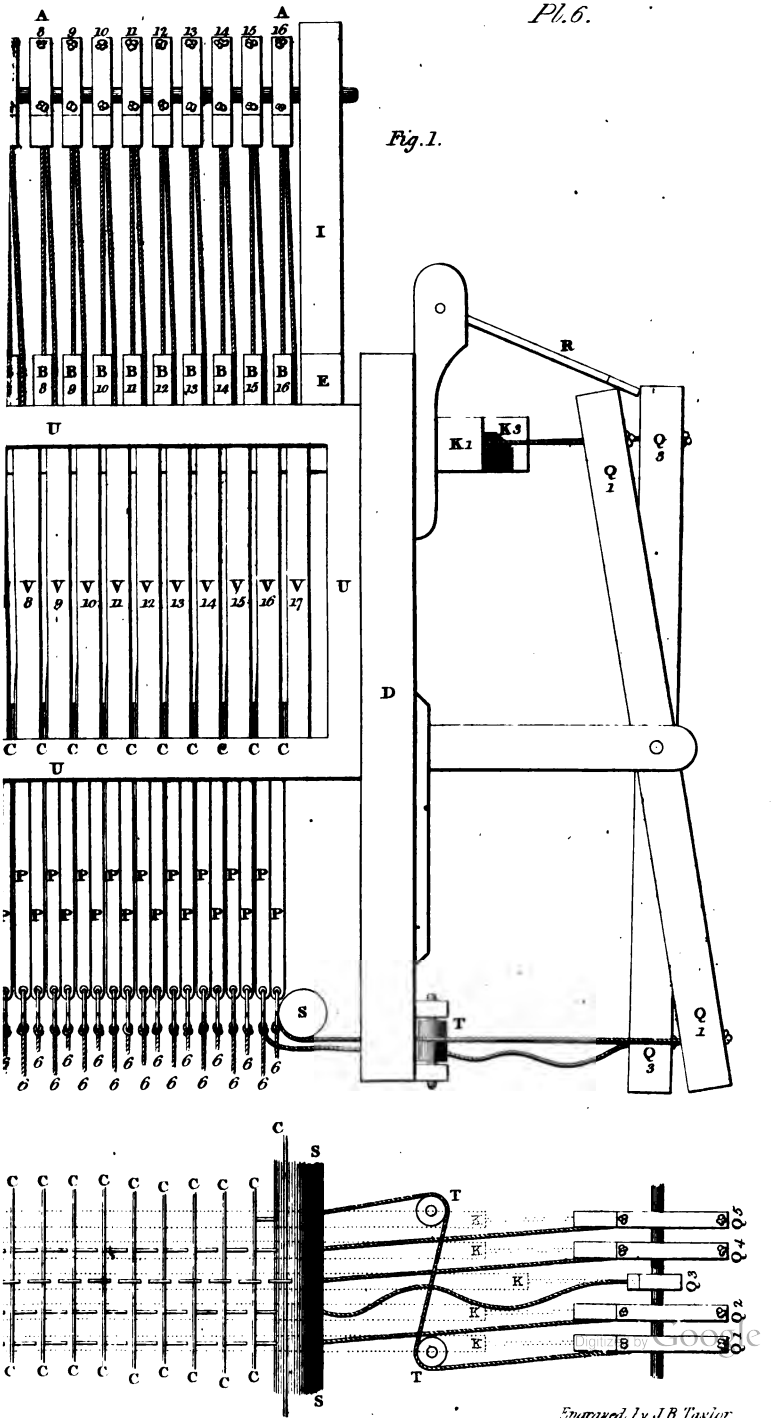
Ribbon Loom.

Pl. 6.

Fig. 1.



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Engraved by J. B. Taylor.

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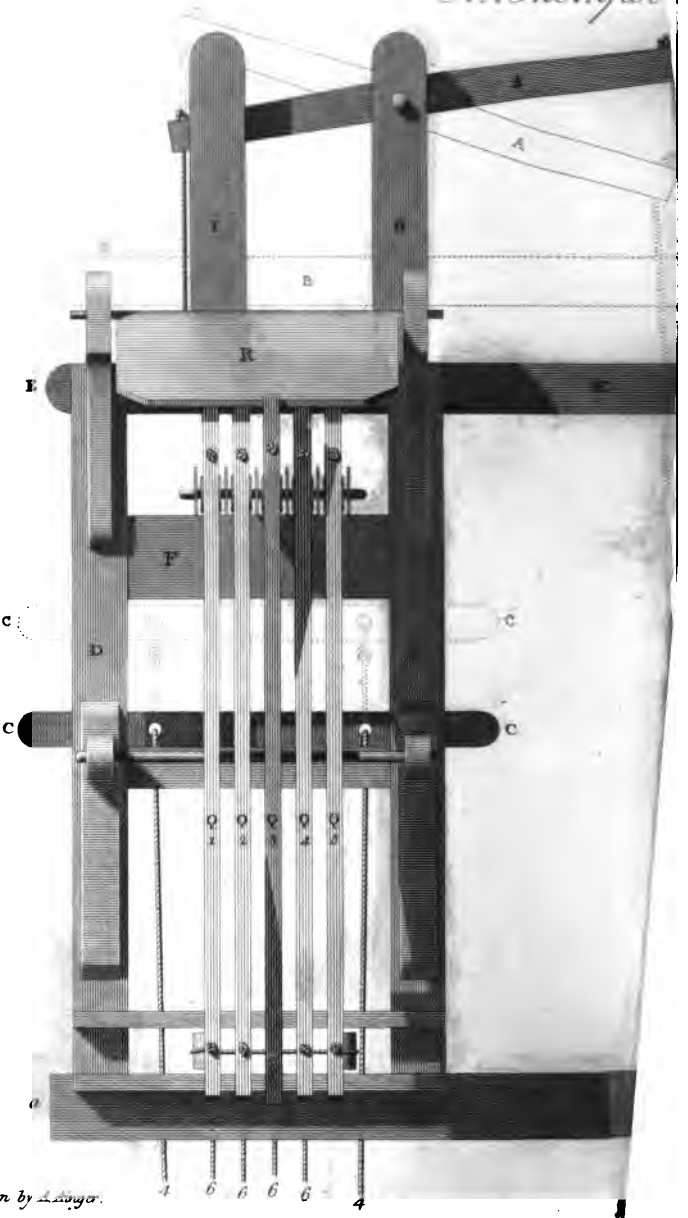
Mr. Thompso



Drawn by A. Singer.

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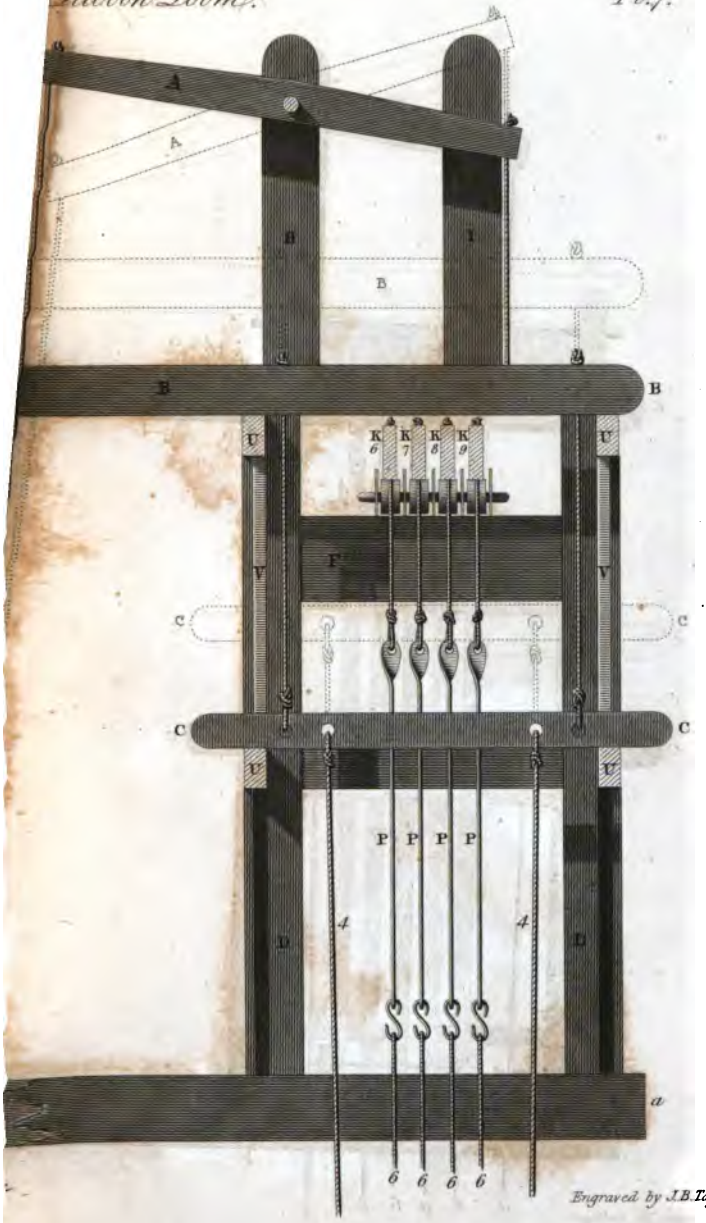
Ribbon Loom.

Pl. 7.



Engraved by J.B. Taylor.

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Method of preparing and hanging Millstones, as practised in Tuscany.

Fig. 1.

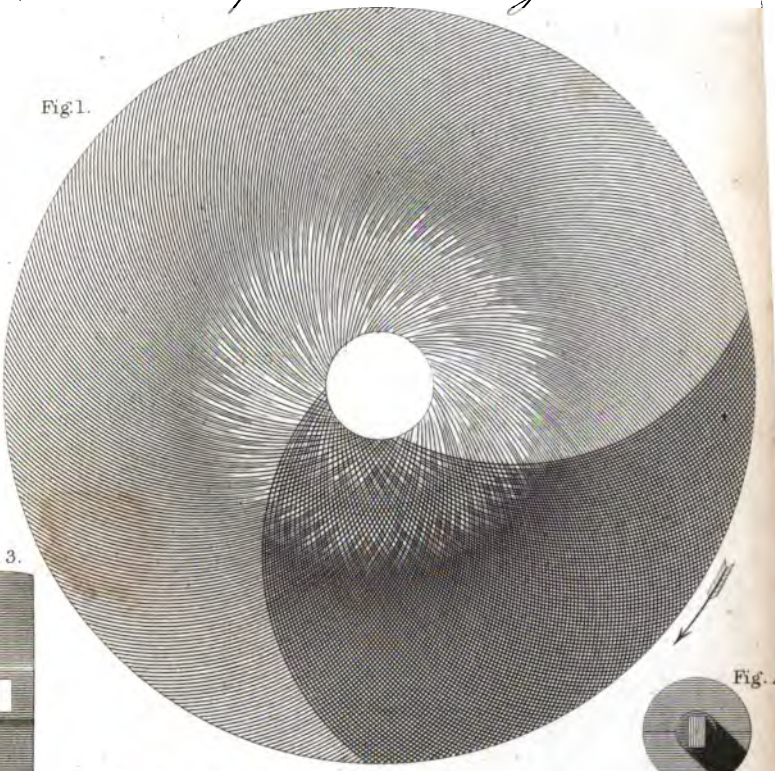
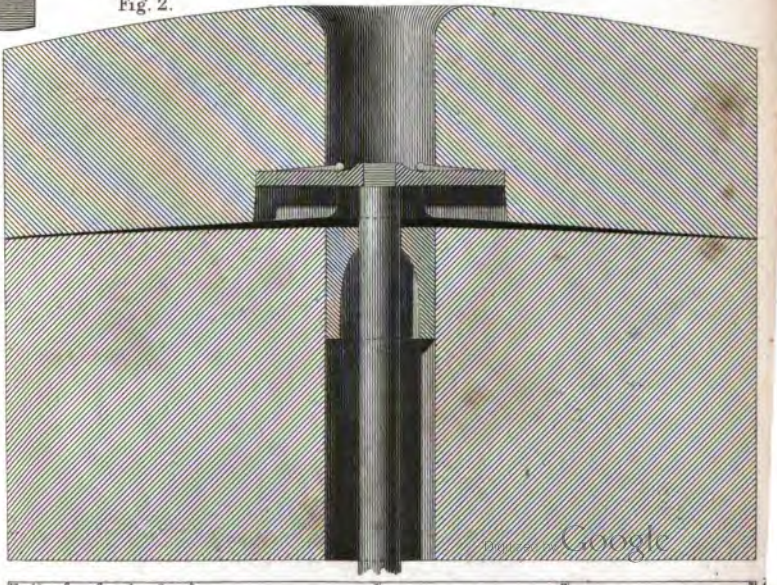


Fig. 3.

Fig. 4

Fig. 2.



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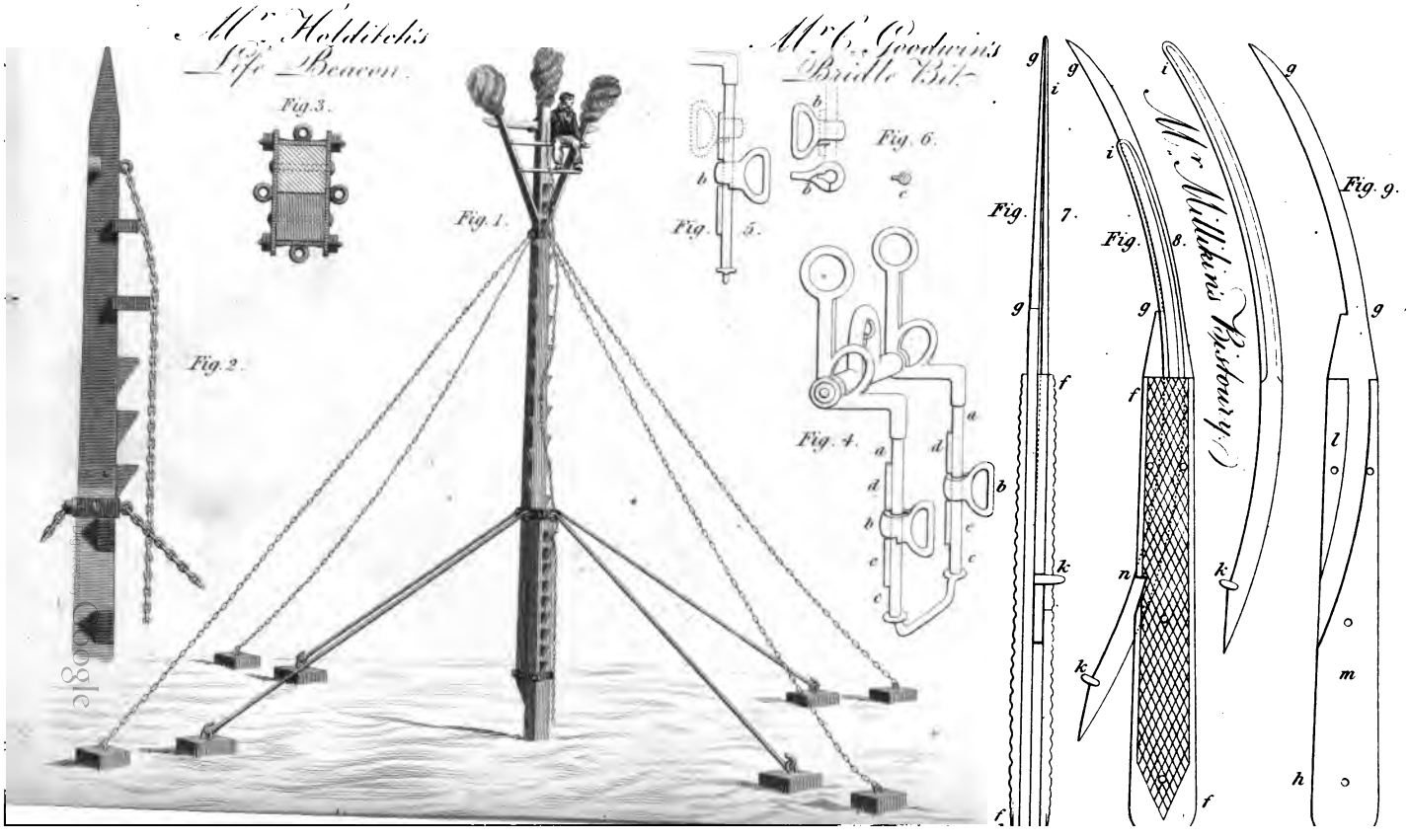

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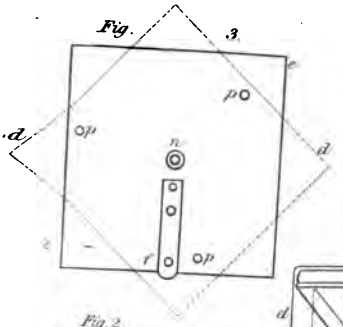
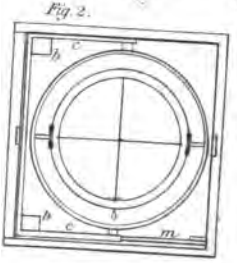
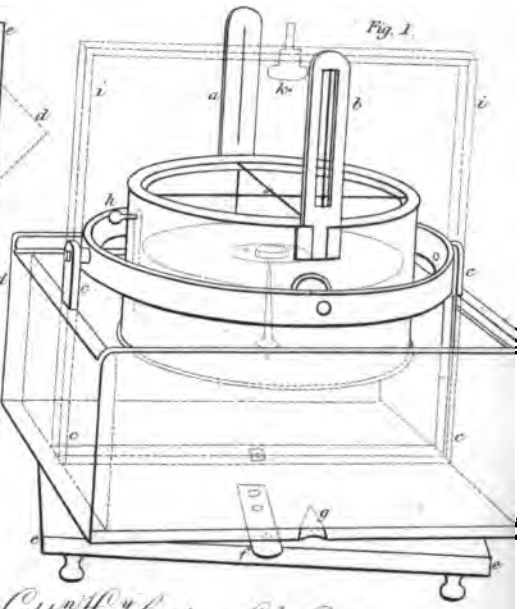
Lieut. Littleworts Compass.

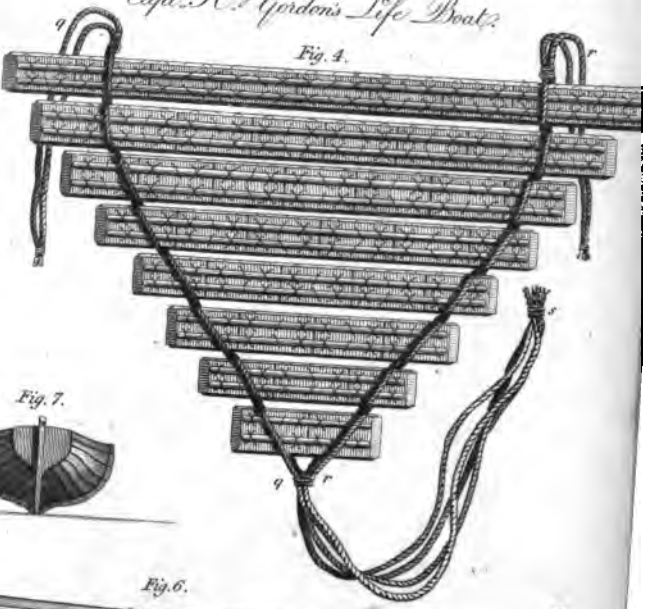






Capt.n H.y Gordon's Life Boat.

Fig. 5.



Drawn by Clarke.

Engraved by A. W. Warren.

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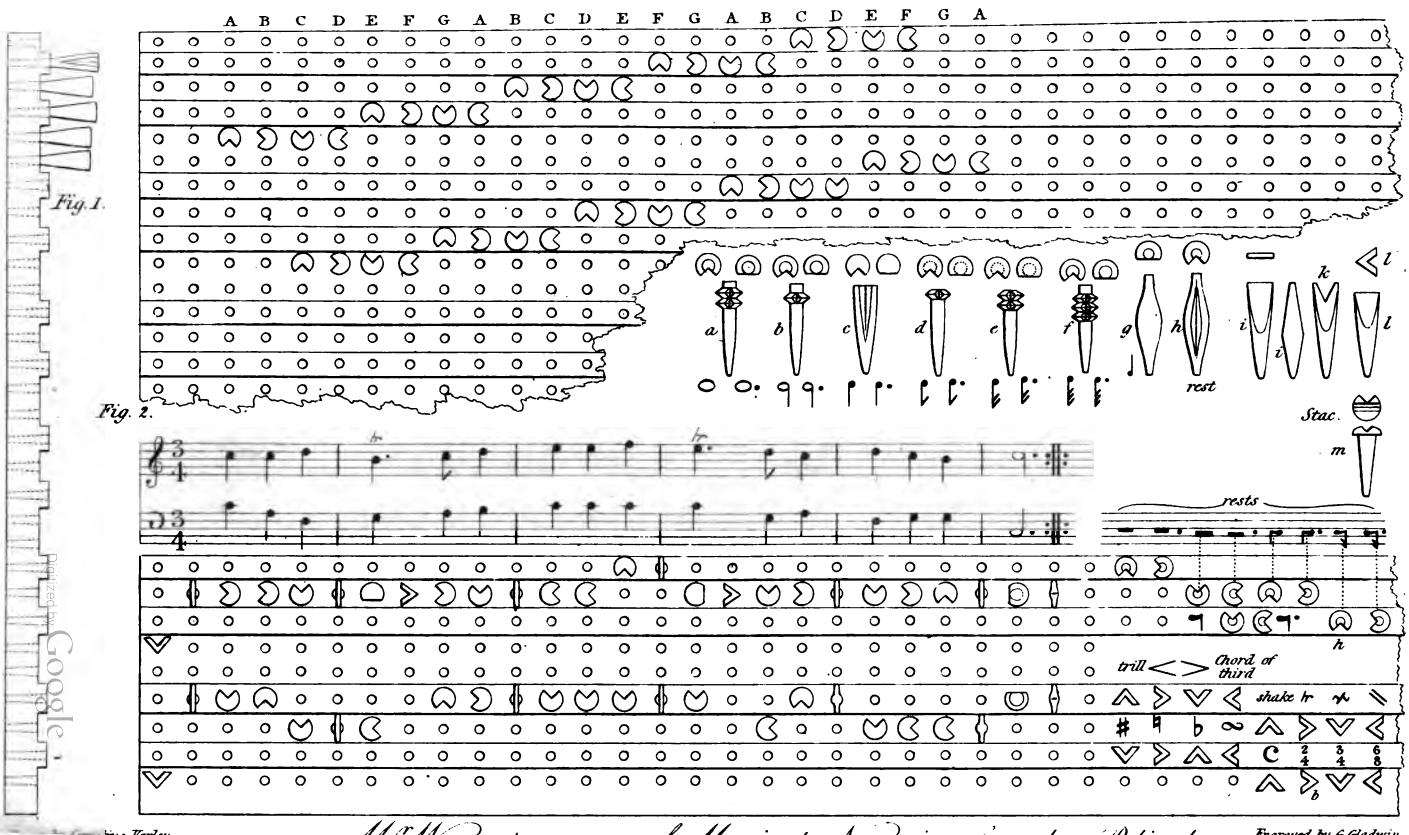

Mr Watson's system of Musical Notation for the Blind.

Engraved by G. Gladwin.

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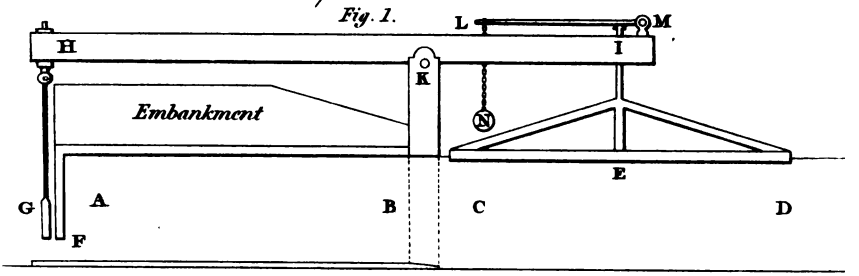
Mr. Thom's apparatus for regulating the Supply of Water to Mills.

Pl.

Fig. 1.



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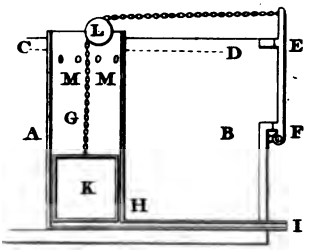

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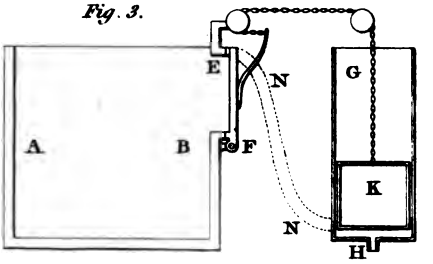

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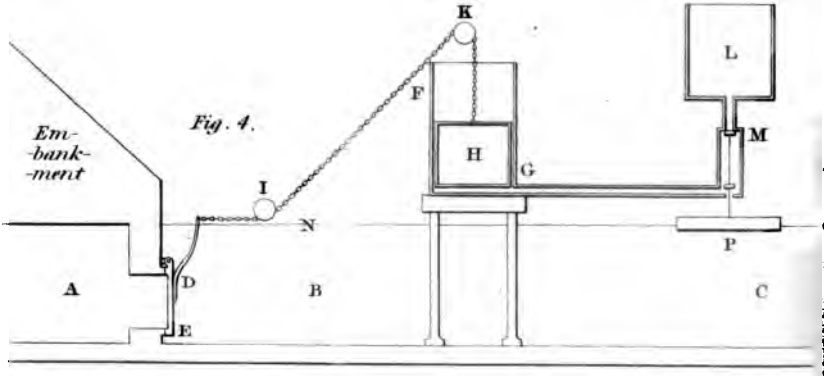

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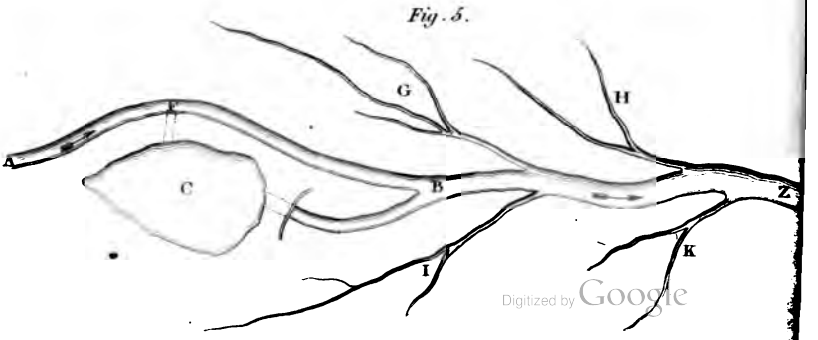

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A. Ainger del.

T. Bradley.

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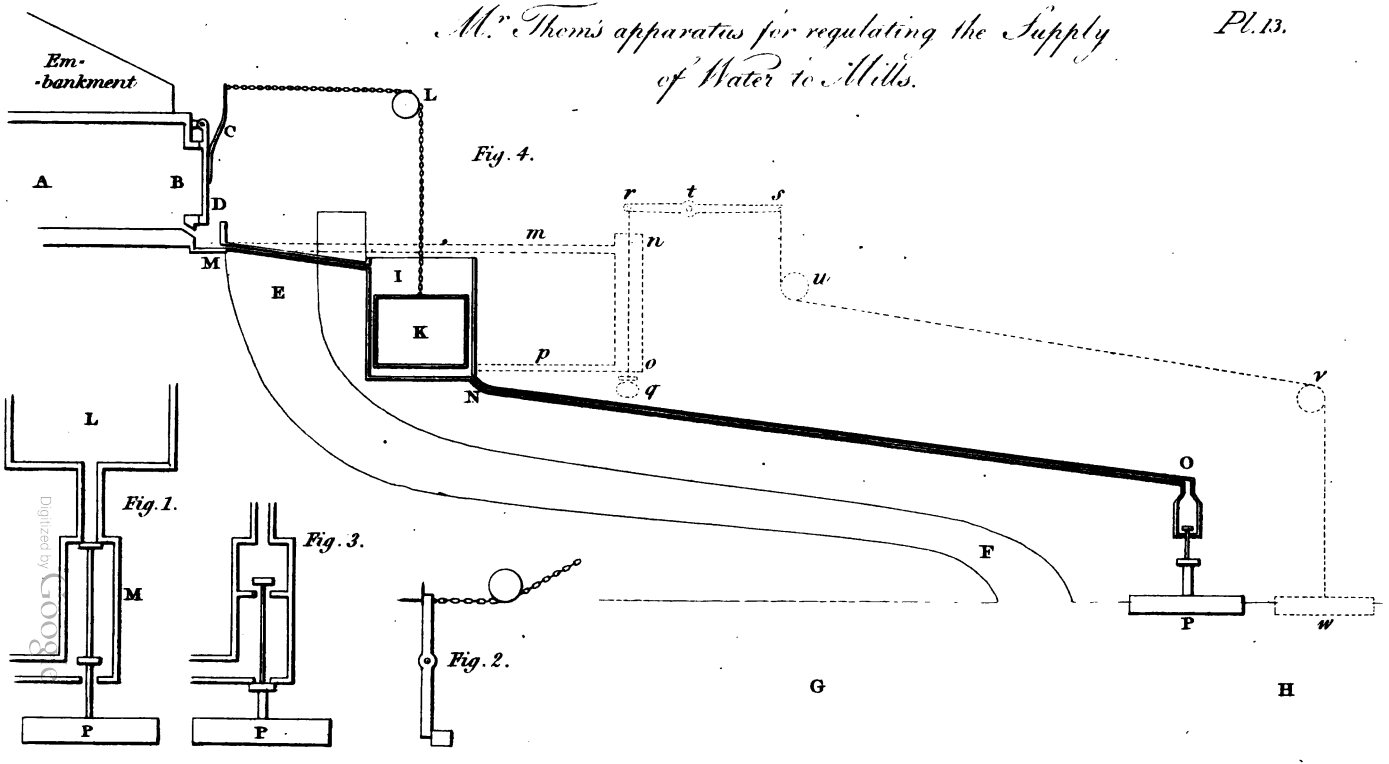
Mr. Thom's apparatus for regulating the Supply of Water to Mills.

Pl. 13.



A. Ainger, del.

Digitized by Google

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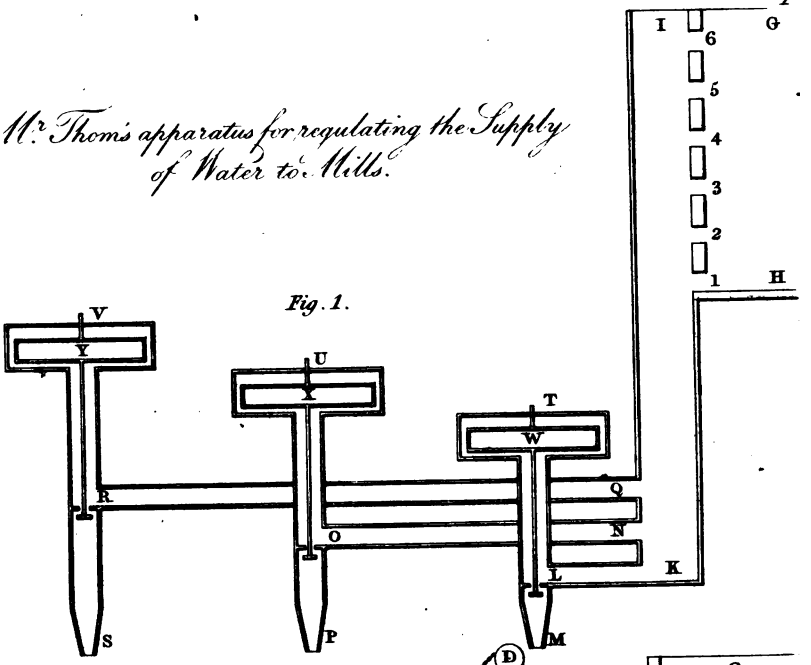
Mr. Thom's apparatus for regulating the Supply of Water to Mills.

Fig. 1.



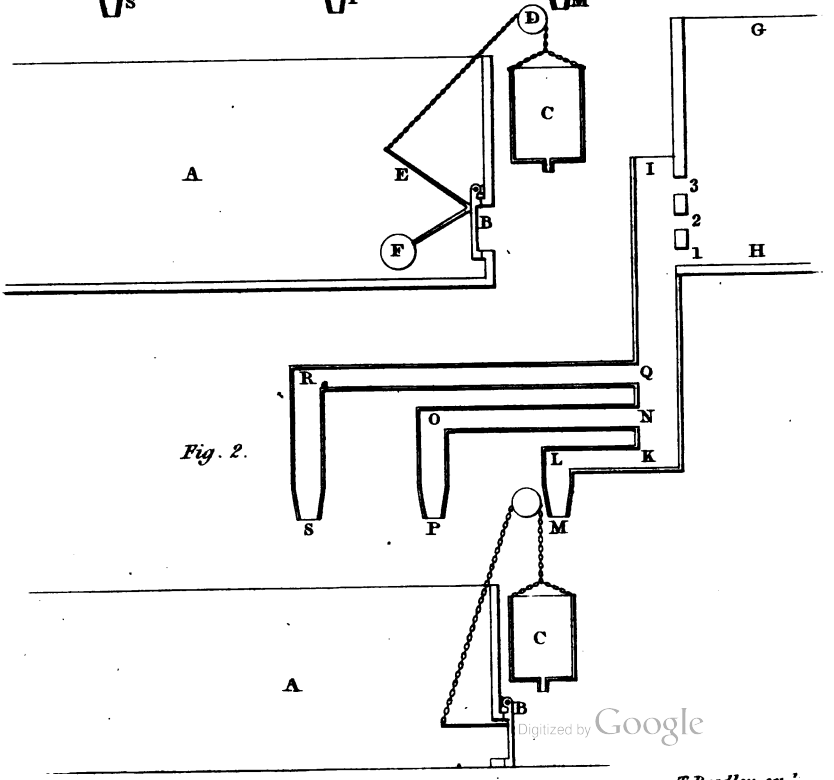


Fig. 2.

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A. Linger, del.

T. Bradley, sc.

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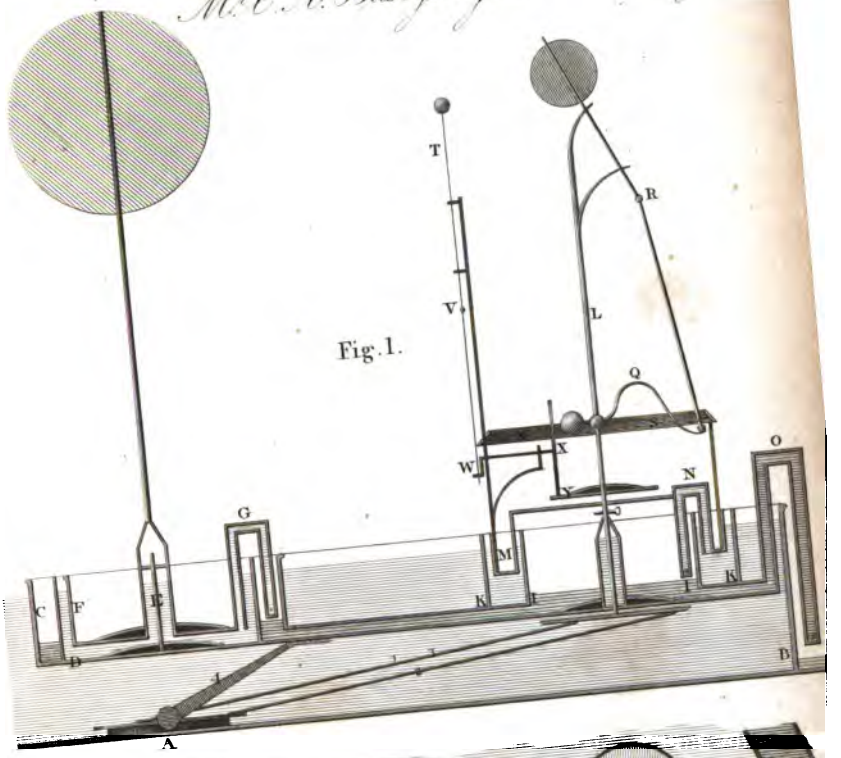
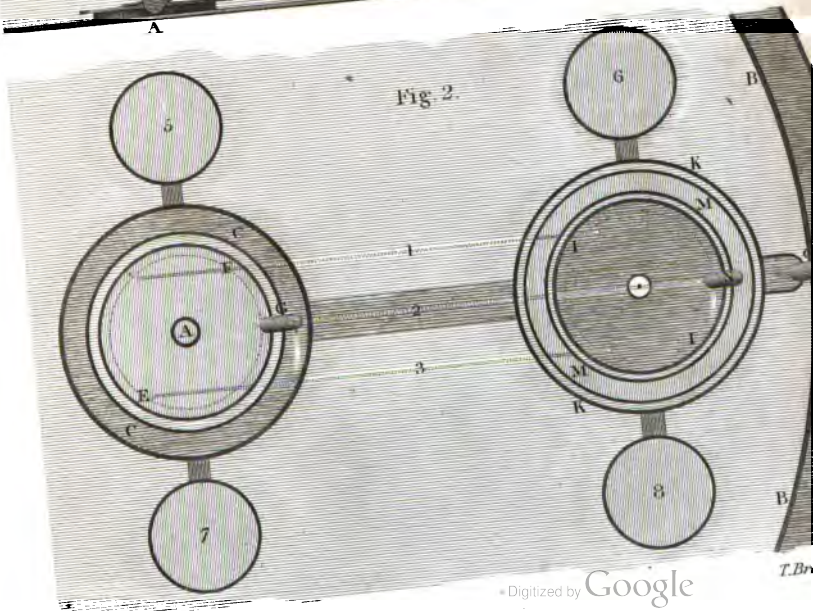
Mr. C. A. Busby's hydraulic Orrery. P





C.A Busby del

T.Br

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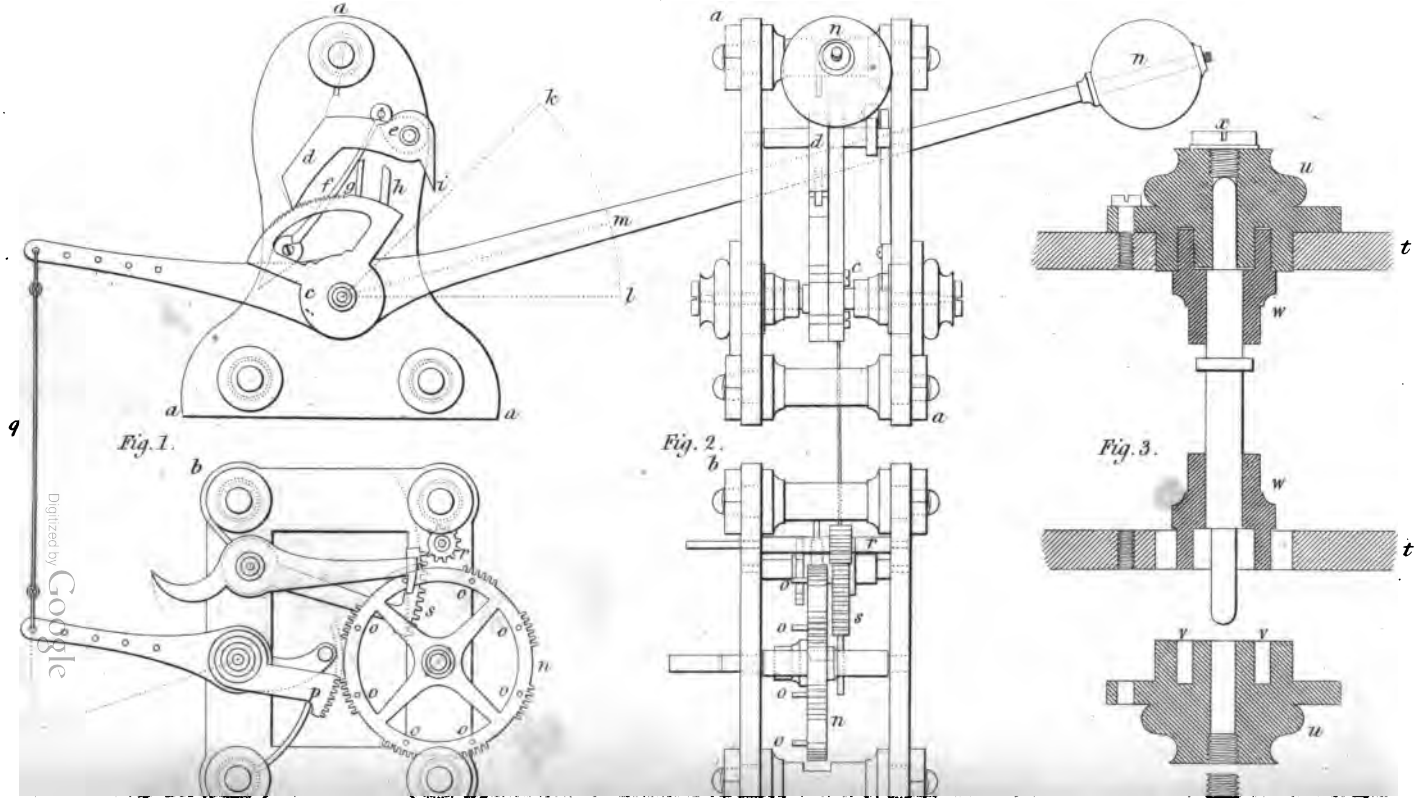
Mr. W. Wynn's striking part of a Turret Clock. Pl. 26.



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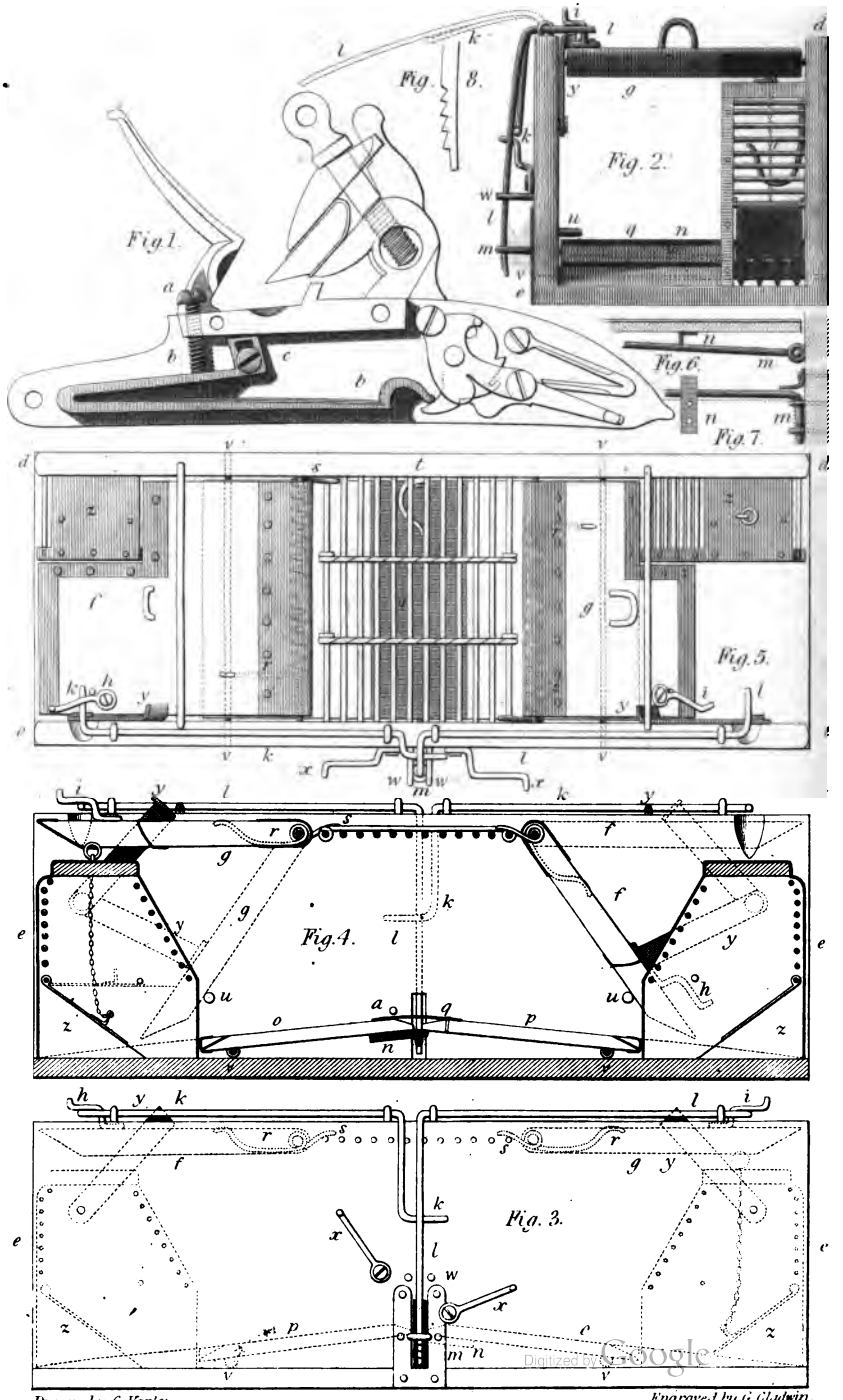
Mr. E. Baker's, Gun Lock. Mr. S. Bowler's, Rat Trap.



Drawn by C. Varley. Engraved by G. Gladwin.

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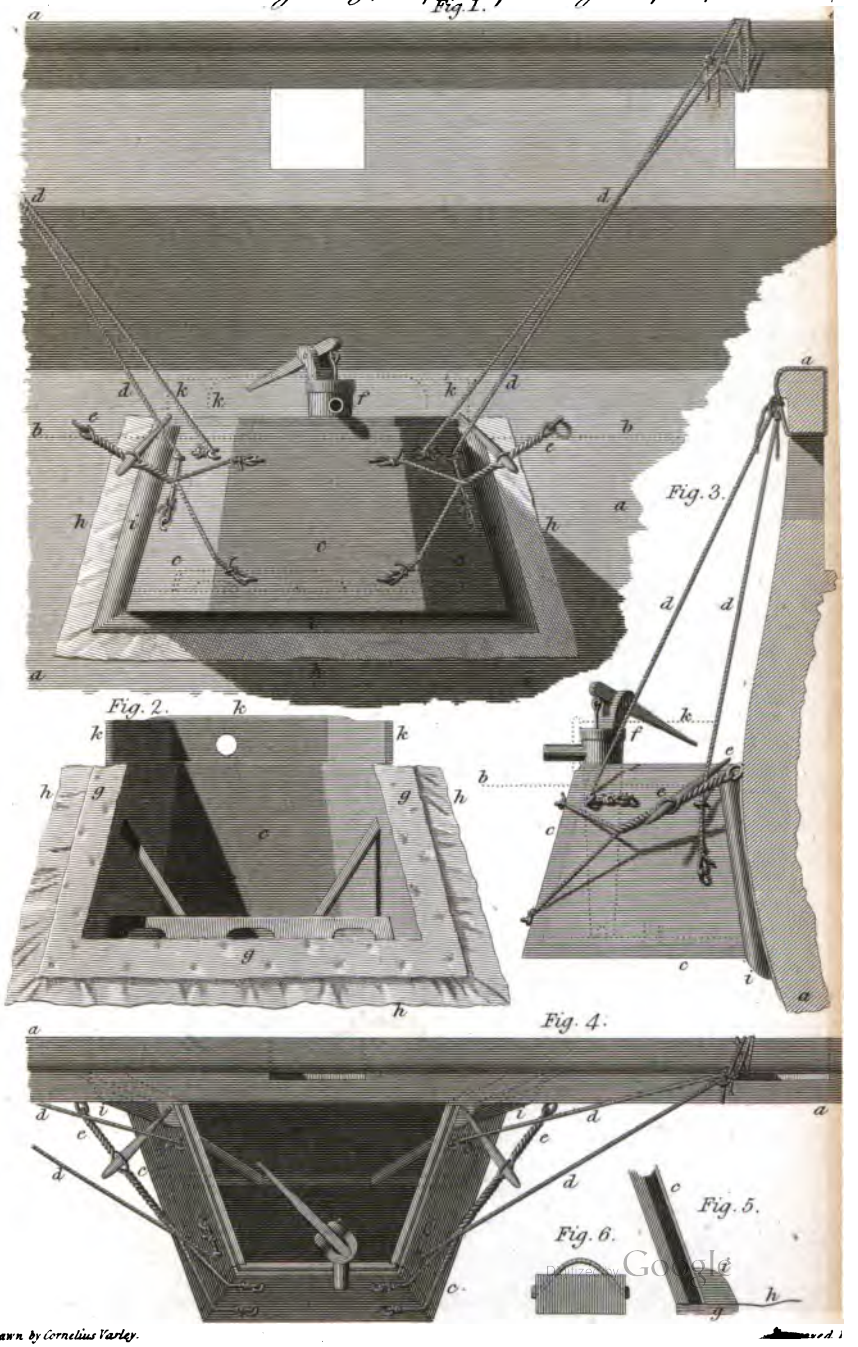
Mr. W. Hooker's Coffer for repairing Ships afloat.

Fig. 1.



Drawn by Cornelius Varley.

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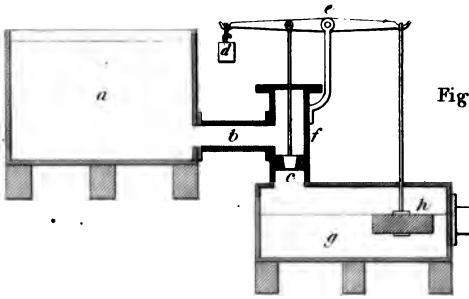
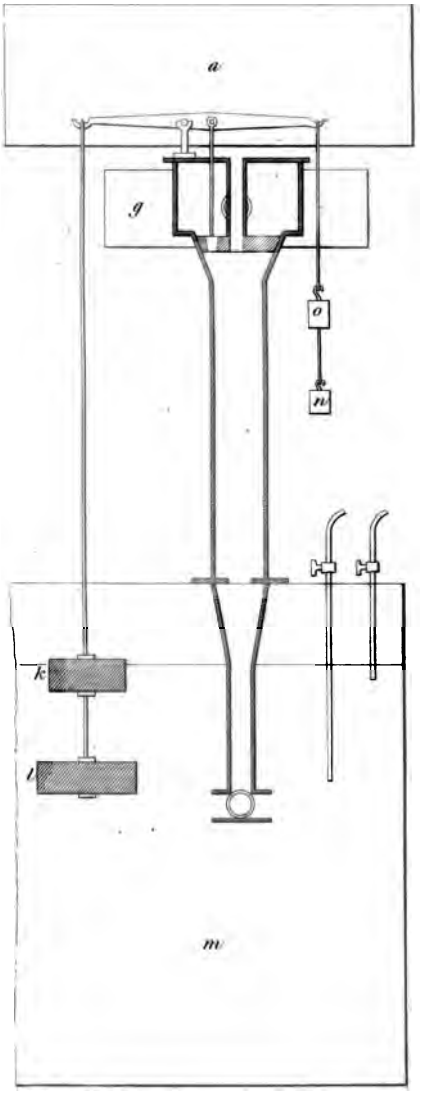


Fig. 1.



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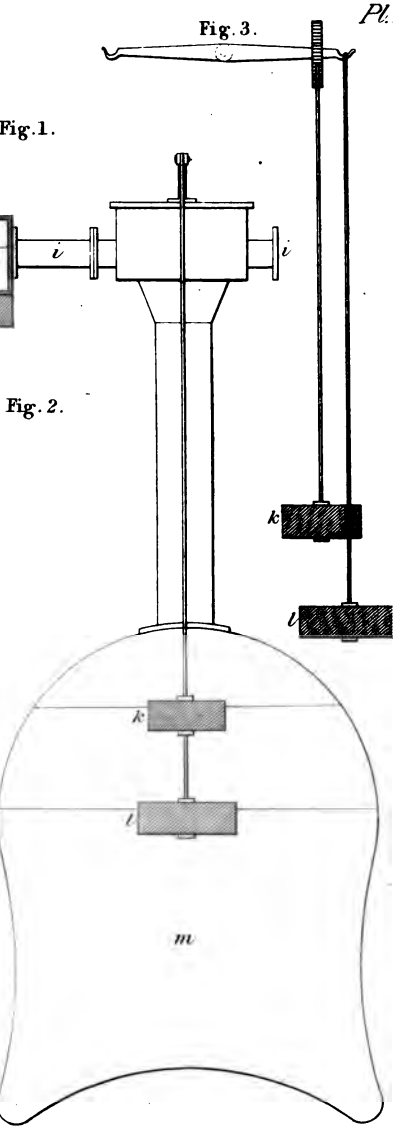

Fig. 3.

Mr. Hall's Apparatus for feeding the boilers of Steam Engines.

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0 5 10 feet

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Pl. 20.

Mr. Eustace Wigzell's instrument for marking a Ships place on a Chart.

Fig. 4.

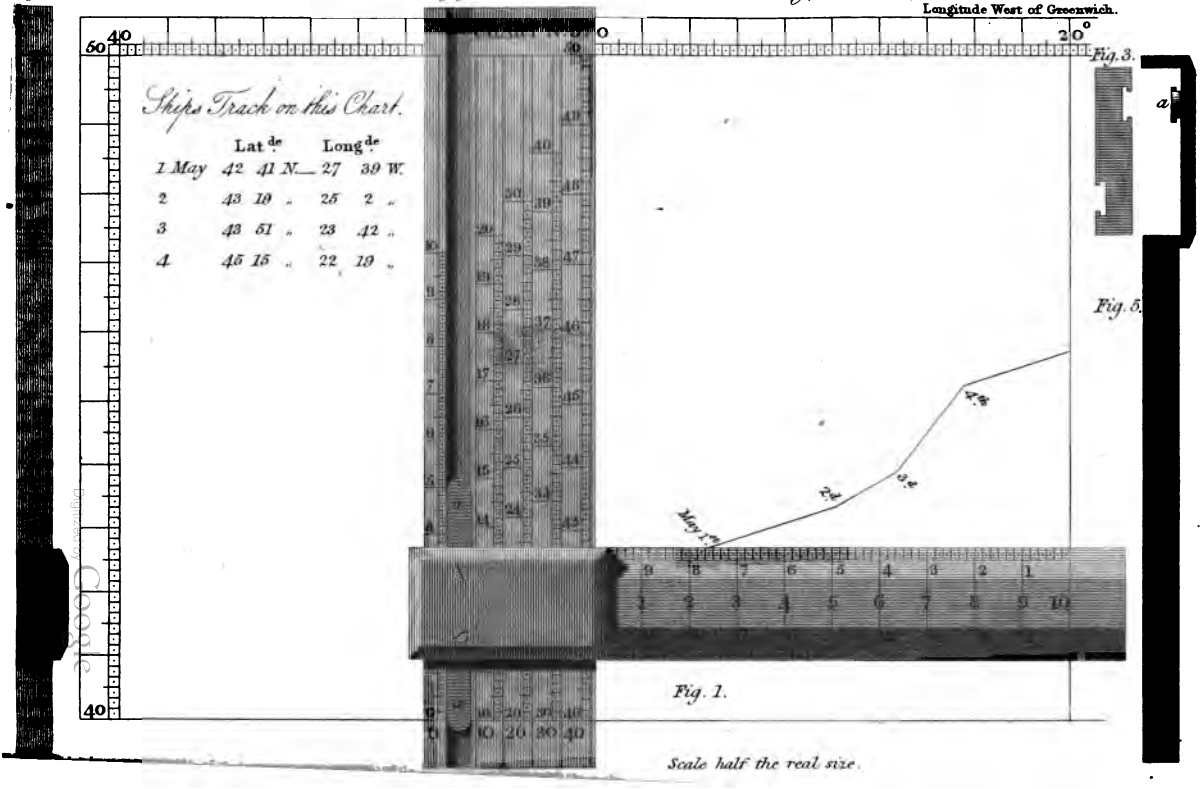
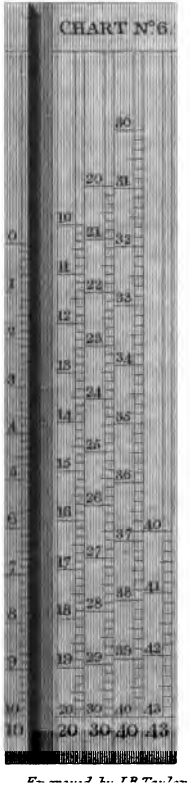


Fig. 2.



Engraved by J.B. Taylor

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Fig. 1.

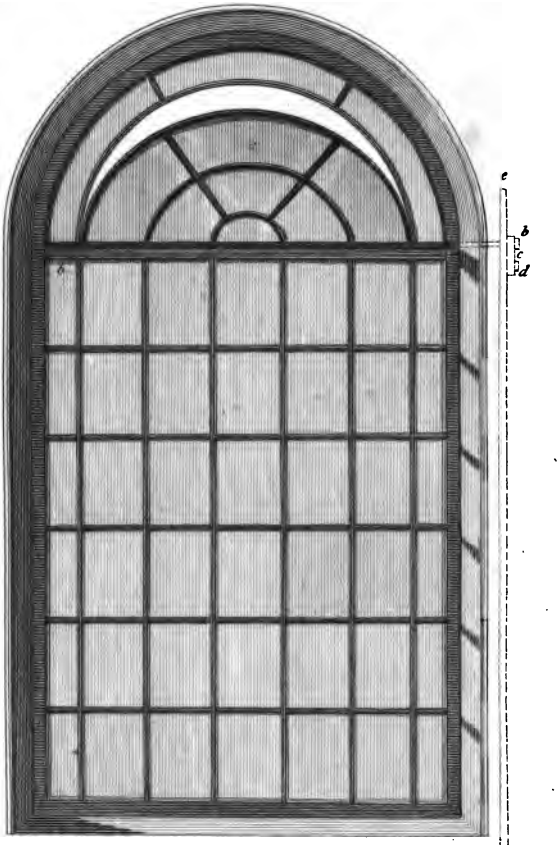
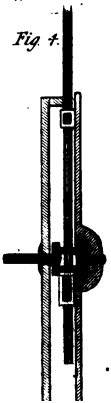


Fig. 2.

Fig. 3.

Fig. 4.



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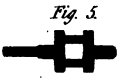

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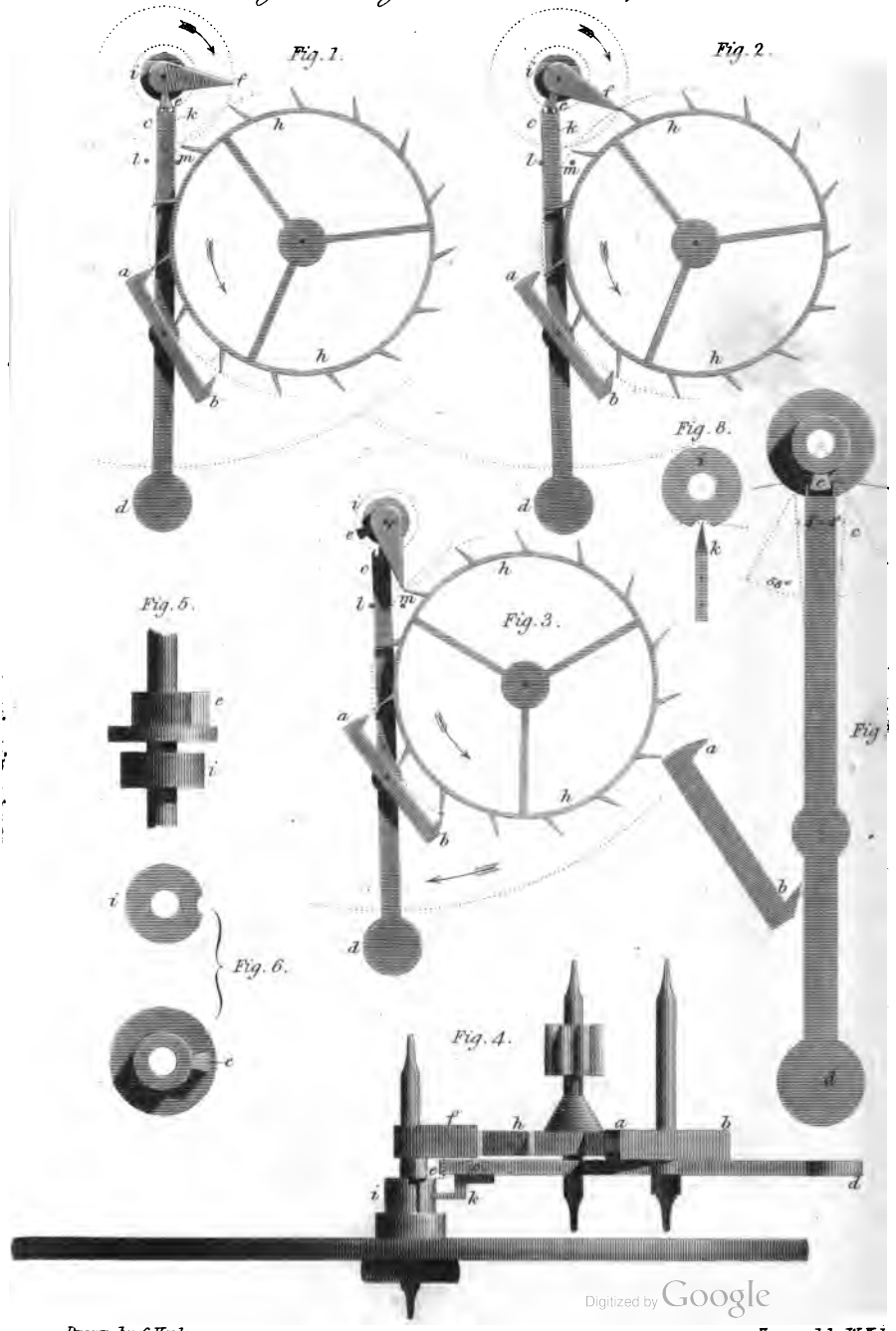
Mr. Geo. Savage's detached Escapement.

Pl



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Engraved by W. Kels

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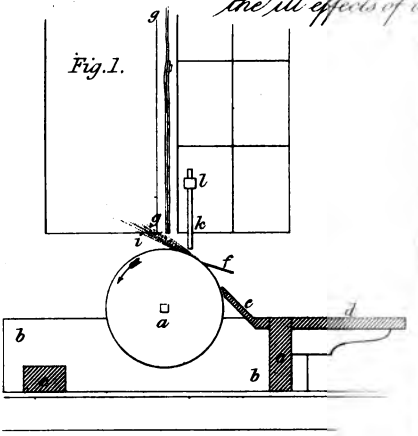
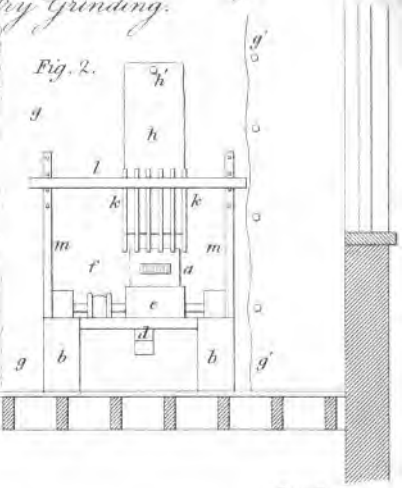
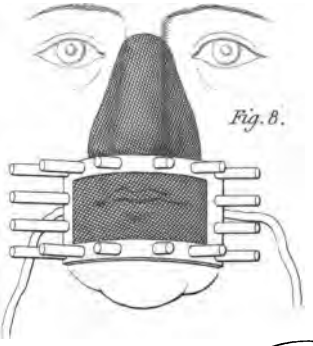
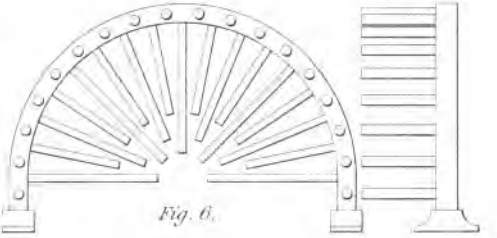
Mr. J. H. Abraham's apparatus for preventing the ill effects of dry Grinding.

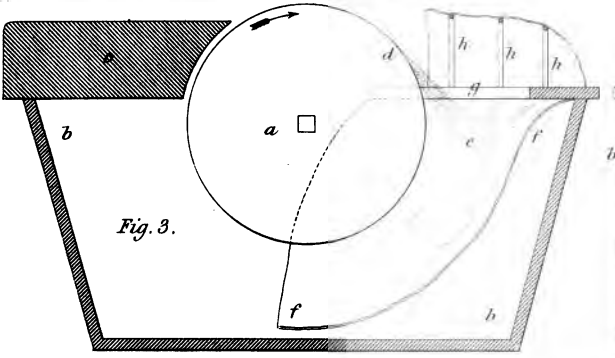
Pl. 23











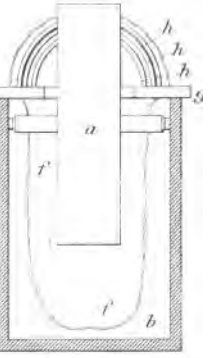
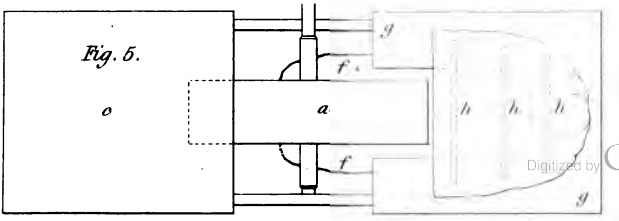


Fig. 4.



A. Ainger delt.

W. Kolwitz sculp.

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Mr. Ainger's Hydrometer.

Scale

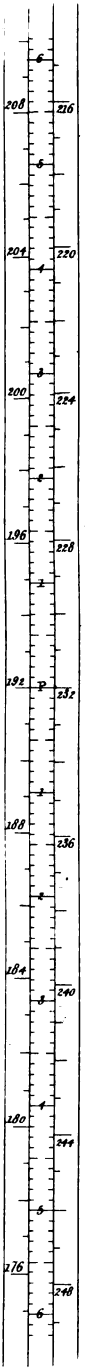


Fig. 2

Fig. 3

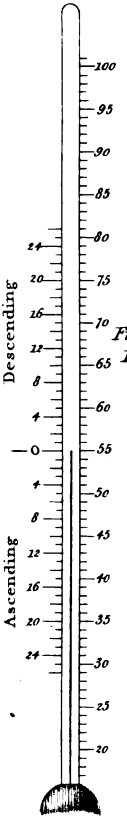


Fig. 1

Method of Knitting Leghorn Plait. Pl. 24.

Fig. 5

Fig. 6

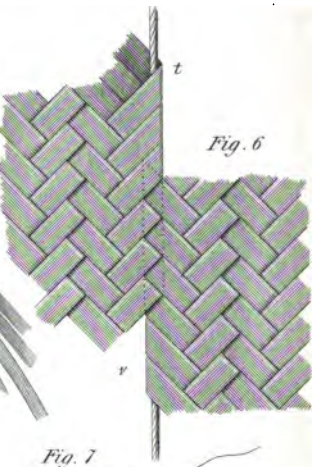


Fig. 9

Fig. 7

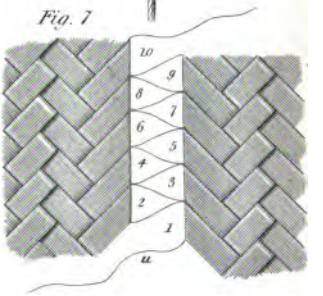
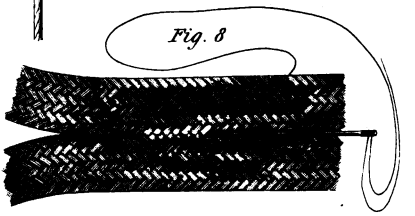
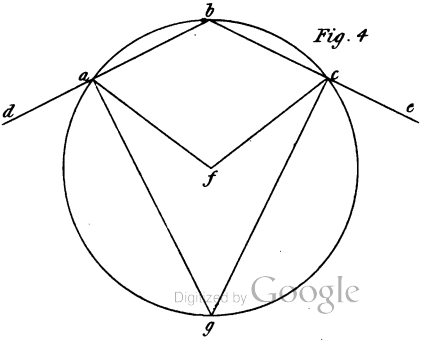


Fig. 8



Mr. Rotch's Arcograph.

Fig. 4



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INDEX.

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INDEX.

A.

ADVERTISEMENT, general, describing the objects of the Society. The Meetings of the Society. The form for proposing Members. Ladies being eligible as Members to vote by proxy at Elections. Members entitled to vote and assist in the business of the Society. Their privilege of recommending two persons as Visitors at the Meetings of the Society, and introducing their friends to examine the various Models, &c., iii. Members to have the use of the Society's Library. Invitation to Members and others, to augment the Library by contributions. Form offered to persons inclined to leave money to the Society by will. The Society not responsible for any opinion or representation of facts contained in their Volumes. The Public guarded against impositions from persons advertising as having Patents for articles rewarded by the Society; and also cautioned against purchasing articles sold under the pretended sanction of the Society's name. Society's Publications. Manner of Communicating, iv.

Agriculture, Conditions to guide Candidates in, vi. Premiums in, vi to xii. Papers in, 1 to 40.

Abraham, Mr., the Large Gold Medal to, for a Magnetic Guard for persons employed in Dry Grinding, xi; his Communication respecting, 135.

Ainger, Mr. A., the Gold Vulcan Medal to, for a General Correctional Scale for Temperature for Hydrometers, xi; his Communication respecting, 160.

Analytical Index of the last Fifteen Volumes, follows this Index.

Appendix, containing impressions from Captain G. W. De Renzy's Wood Blocks, representing various articles of an Apparatus invented and adopted by him, for the use of those

Digitized by Google

who have lost a hand, for which he received the Thanks of the Society, 241.

Arnold, Miss S. M., the Large Silver Medal to, for a Painting in Oil, xxxvi.

B.

Bailey, Mr. W., the Silver Vulcan Medal to, for an Improved method of Opening and Shutting the Windows of Churches, &c., xi. his Communication respecting, 173.

Baker, Mr. E, the Silver Vulcan Medal to, for an Improved Main Spring for Fire Arms, xi; his Communication respecting, 118.

Biddle, Mr. A., The Large Silver Medal to, for a Hay-Borer, xxxvi; his Communication on the subject, 36.

Birch, Miss M., the Silver Palette to, for a copy in Indian Ink, xxxviii.

Bistoury, Mr. J. Millikin's Communication on an Improved, 69.

Bowler, Mr. S., Five Guineas to, for a Rat-trap, xi; his Communication respecting, 154.

Bowley, Miss E., the Silver Isis Medal to, for a Painting in Water Colours, xxxvii.

Bridges, Mr. J., the Large Silver Medal, with a Gold Rim, for a Copy in Oil, xxxvii.

Bridle Bit, Mr. C. Goodwin's Communication respecting, 66.

Bunning, Mr. J. B., the Silver Isis Medal to, for an Architectural Drawing, xxxix.

Busby, Mr. C. A., the Gold Vulcan Medal to, for an Hydraulic Orrery, xi; his Communication respecting, 98.

C.

Calico Printers, Mr. Marshall's Improved Blocks for, 178.

Candidates, General Notice to, v.

Clarke, Miss E., the Silver Isis Medal to, for a Copy in Chalk, xxxviii.

Coffer for repairing Ships afloat, Mr. W. Hookey's Communication on a, 122.

Digitized by Google

Cowley and Staines, Messrs., the Large Gold Medal to, for drawing Turnips in the month of November, 1821, and preserving the same in a sound state, fit for feeding Cattle, to the end of April, 1822, xxxvi; their Communication respecting, 29.

——— Thirty Guineas to, for cultivating 4 acres of the White Poppy (*Papaver Somniferum*), and extracting from it, 60 *lbs.* of solid Opium, &c., xxxvi; their Communication respecting, 9.

Corbett, Mr. P., the Silver Isis Medal to, for a Copy in Oil, xxxvii.

D.

Davies, Miss E., the Large Silver Medal to, for a Copy in Oil, xxxvii.

Denman, Mr. J. F., the Silver Palette to, for a Copy in Indian Ink, xxxvii.

De Renzy, *George Webb*, Esq., the Thanks of the Society to, for his offer of the Wood Blocks, representing various articles of an Apparatus invented and adopted by him, for the use of those who have lost a hand, 241.

Detached Escapement, Mr. G. Savage's Communication on a, 151.

Draw-boy, Mr. J. Hughes's Improvement in the Silk Weaver's, 181.

——— Mr. Richards's Improvement in the Silk Weaver's, 181.

Drummond, Miss E. A., the Gold Isis Medal to, for a Portrait in Oil, xxxvi.

——— Mr. S., the Silver Isis Medal to, for a Copy in Oil, xxxvii.

Dry Grinding, Mr. Abraham's Communication on a Magnetic Guard for persons employed in, 135.

E.

Evatt, Miss C. H., the Silver Isis Medal to, for a Portrait in Oil, xxxvii.

F.

Fairland, Mr. T., the Silver Isis Medal to, for a Drawing in Chalk, xxxviii.

Digitized by Google

Fairland, Mr. T., the Silver Isis Medal to, for an Outline, xxxviii.

——— Mr. W., the Silver Isis Medal to, for an Anatomical Drawing, xxxviii.

Fancourt, Mr. E., the Large Silver Medal to, for a Portrait in Oil, xxxvi.

Farrer, Mr. J. H., the Silver Isis Medal to, for a Copy in Water Colours, xxxvii.

Faulkener, Mr. B., the Large Silver Medal to, for a Medal Die, xxxix.

Fire Arms, Mr. E. Baker's Communication on an Improved Main Spring for, 118.

G.

Gill, Mr. W., the Silver Isis Medal to, for a Drawing in Chalk, xxxviii.

Glaze for Vessels of common Red Earthenware, Mr. Meigh's Communication respecting, 44.

Goodwin, Mr. C., the Large Silver Medal to, for a Bridle Bit, xi; his Communication respecting, 66.

Gordon, H. Esq., Captain, R. N., the Silver Vulcan Medal to, for a Life Boat, xi; his Communication respecting, 73.

Gwennap, Mr. T., the Gold Isis Medal to, for a Painting in Oil, xxxvii.

H.

Hall, Mr., Ten Guineas to, for a Self-acting Apparatus for supplying Steam Boilers with Water, xi; his Communication respecting, 127.

Hay-Borer, the Large Silver Medal to Mr. A. Biddle, for a, xxxvi; his Communication respecting, 36.

Heape, Miss M., the Large Silver Medal to, for a Composition in Water Colours, xxxvii.

Hefer, Miss S., the Silver Palette to, for a Painting in Water Colours, xxxvii.

Holditch, Mr. G., the Large Silver Medal and Ten Guineas to, for a Life Beacon, xi; his Communication respecting, 61.

Digitized by Google

Holmes, Mr. M. H., the Silver Palette to, for a Composition in Water Colours, xxxvii.

Hookey, Mr. W., the large Silver Medal to, for a Coffer for repairing Ships Afloat, xi; his Communication respecting, 122.

Horne, Mr. R. H., the Silver Palette to, for a copy in Indian Ink, xxxvii.

Howard, Mr. F., the Silver Palette to, for a Drawing in Chalk, xxxviii.

Hudson, Mr. R., the Large Silver Medal to, for a Composition in Water Colours, xxxvii.

Hughes, Mr. J., Five Guineas to, for improving the Silk Weaver's Draw-boy, xxxix: his Communication respecting, 181.

Hydraulic Apparatus, Mr. R. Thom's Communication respecting, 81.

Hydraulic Orrery, Mr. C. A. Busby's Communication on, 98.

Hydrometers, Mr. A. Ainger's Communication on a General Correctional Scale for Temperature for, 160.

I.

Index, an Analytical of the last 15 volumes, follows the Index.

K.

Knight, Mr. E. the Large Silver Medal to, for a Landscape in Oil, xxxvii.

Knight, Mr. J., the Large Silver Medal to, for a Copy in Oil, xxxvii.

L.

Land, The Large Gold Medal to J. Peart, Esq., for reclaiming, xxxvi.

Leghorn Straw, Mr. J. Parry's Method of Manufacturing Plat from, 222.

———, Communication respecting a new material for fine Plat, in imitation of, 217.

Legrew, Mr. J., the Silver Palette to, for a Model in Plaster, xxxviii.

Life-Beacon, Mr. G. Holditch's Communication on, 61.

Life-Boat, Captain Gordon's Communication respecting, 73.

Digitized by Google

Littlewort, Lieutenant, R. P. (R. N.) the Large Silver Medal to, for a Ship's Compass, xi; his Communication respecting, 70.

Loom, Mr. J. Thompson, junior's, Improvement in the Silk Ribbon, 195.

Lupton Mr. T., the Gold Isis Medal to, for a Portrait in Mezzotinto on soft Steel, xxxix; his Communication respecting, 41.

M.

Macartan, Mr. L., the Silver Isis Medal to, for a Drawing in Chalk, xxxviii.

M'Arthur, J. Esq., the Large Gold Medal to, for importing 15,130*lbs.* of fine Wool, the produce of his own flock in New South Wales, xi; his Communication respecting, 230.

——— the Large Gold Medal to, for importing certain quantities of Wool, equal to the fine Electoral Saxon Wool, &c. xi; his Communication respecting, 230.

Marbles, Resolution respecting bringing the British, into general use, xxv.

Marshall, Mr. S., Fifteen Guineas to, for Blocks for Calico Printers, xxxix; his Communication respecting, 178.

Meigh, Mr. J., the Large Gold Medal to, for the Discovery of a Glaze for Vessels of Common Red Earthenware, xi; his Communication respecting, 44.

Middleton, Mr. J., the Large Silver Medal to, for an Anatomical Drawing, xxxviii.

Millikin, Mr., the Large Silver Medal to, for a Bistoury, xi; his Communication respecting, 69.

N.

New Material for Hats, the Thanks of the Society to Mr. W. Pritchard, for his Communication respecting a, 228.

New South Wales, Communication respecting fine Broad Cloth made of Wool from, 230.

——— Communication on the importation of fine Wool, from, 230.

——— Communication on importing certain quantities of Wool from, 230.

——— Communication on the Importation of Sea-Elephant Oil, procured within the limits of the colony of, 238.

Digitized by Google

Nicholson, Mrs., the Gold Isis Medal to, for an Historical Picture in Needlework, xxxix.

Nicholson, Mr. G. the Silver Isis Medal to, for a Drawing in Pen and Ink, xxxvii.

P.

Padgett, Mr. J., the Silver Palette to, for a Drawing in Chalk, xxxviii.

Palin, Miss, the Silver Palette to, for a copy in Chalk, xxxviii.

Papendick, Mr. C., the Large Silver Medal to, for an Architectural Design, xxxix.

Parry, Mr. J., the Large Silver Medal to, for the Manufacture of Plat from Leghorn Straw, xxxix; his Communication respecting, 222.

Peacock, Miss E. H., the Silver Isis Medal to, for a Copy in Chalk, xxxviii.

Peart, J. Esq., the Large Gold Medal to, for Reclaiming 56 Acres of Waste Moor Land, xxxvi; his Communication respecting, 1.

Pering, Mr. R., the Silver Vulcan Medal to, for a Wrought-Iron Carriage for Ship's Guns, xi; his Communication respecting, 54.

Phelps, Mr. J., the Silver Isis Medal to, for a Copy in Pen and Ink, xxxviii.

Platt, Mr. S., the Gold Isis Medal to, for an Oil Painting, xxxvi.

Plowman, Mr. W. T., the Large Silver Medal to, for an Architectural Design, xxxix.

Poppy, Thirty Guineas to Messrs. Cowley and Staines, for Cultivating four Acres of the White, xxxvi.

Preece, Mr. J., the Silver Isis Medal to, for a Model in Plaster, xxxviii.

Premiums offered by the Society, vi to xxxvi.

Premiums In Agriculture, viz:

Agriculture, Conditions to guide candidates, vi. Premiums in vi to xii. Papers in, 1 to 40.

Beans, for the discovery and cultivation of a species of Horse-beans or Tick-beans, viii.

Digitized by Google

Premiums in Agriculture continued, viz.

Beets, for the best and cheapest method of preserving, ix.

Cabbages, for the best and cheapest method of preserving Drum-headed, x.

Candidates, general notice to, v.

Carrots, for the best and cheapest method of preserving, ix.

Cashmere Shawl-Goat, for having kept in a healthy state the greatest number of Cashmere Shawl-Goats, xi.

Cattle, for the best experiments on stall-feeding, x.

Clover Plants, for the best methods employed in preventing the rotting of, ix.

Destroying the Fly on Hops, for the discovery of an easy and effectual method of, x.

——— *the Grub of the Cockchafer*, for an effectual method of, x.

Dibbling Machine, for the invention of one superior to any hitherto known, xi.

Forest Trees, for having inclosed and planted, or set the greatest number of, vi.

Gaining Land from the Sea, for having gained the greatest quantity of, vi.

Grass, for the comparative merit of laying down light land to permanent, vi.

——— *Seeds*, for raising the greatest quantity of, viii.

Harvesting Corn in Wet Weather, for the best and cheapest method of, x.

Hemp, for having sown the greatest quantity of land with, ix.

Improving Waste Land, for the most satisfactory account of the best method of, vi.

Irrigation of Land, for the cheapest and most effectual method of raising water for the, xi.

Larch, for having planted the greatest number of, vii.

Mangel Wurzel, for the best and cheapest method of preserving, ix.

Digitized by Google

Premiums in Agriculture continued, viz.

Manures, for the most satisfactory set of experiments to ascertain the comparative advantages of, vi.

Norway Fir Seedlings, for having planted the greatest number of, vii.

Oaks, for the best method of raising, viii.

——, to the person who shall have raised the greatest number of, vii.

——, for having set the greatest quantity of land with Acorns, vii.

Opium, for obtaining the greatest quantity of, from the white Poppy (*Papaver somniferum*), ix.

Paring Plough, for the production of one superior to any hitherto known, xi.

Parsnips, for the best and cheapest method of preserving the roots perfectly sound, ix.

——— for the cultivation of the greatest quantity of land with, ix.

Plantations, for the most effectual and least expensive method of securing young, viii.

Potatoes, for the cultivation of the greatest quantity of land with, ix.

Preventing the Blight on Fruit Trees and Culinary Plants, for the most effectual method of, x.

——— *the ill-effects of Flies on Sheep*, for the most effectual method of, xi.

——— *the rotting of Clover Plants*, for the best methods employed in, ix.

Securing Plantations, for the most effectual and least expensive method of, viii.

Sheep, for having protected the greatest number of, xi.

—— for the most effectual method of curing the rot in, xi.

—— for the most effectual method of preventing the ill-effects of Flies on, xi.

Thrashing Machine, for the Invention of an expeditious, effective, and moderately expensive, xii.

Turnips, Carrots, Parsnips, Beets, or Mangel Worzel, for the best and cheapest method of preserving, ix.

Digitized by Google

Premiums in Agriculture continued, viz.

Walnuts, for an improved mode of propagating the superior varieties of, viii.

——— *Trees*, for having planted the greatest number of, vii.

Wheat, for the best set of Experiments, to be sown broad-cast, drilled, and dibbled, viii.

Premiums offered for the Advantage of the Commerce of the United Empire, and the British Colonies, xxx to xxxv.

Annatto, for the importation of the greatest quantity of, xxxv.

Borer, for an effectual method of destroying the insect commonly called the, xxxii.

Cashmere Shawl-Goat, for importing the greatest number of, xxxiv.

China Paper for Copper-Plate Printing, for the best account of the process employed in China for the manufacture of, xxxiv.

——— *Tea*, for the best and most authentic account of the culture of the plant or plants, the leaves of which furnish the different kinds of Tea, xxxv.

Cocoa-Nut Oil, for the importation of the largest quantity of, xxxiii.

Curing Mackarel, for curing the greatest quantity of, xxxii.

Hemp, for the cultivation of, in Lower Canada, xxxiii.

——— for the cultivation of, in Nova Scotia and New Brunswick, xxxiii.

——— for the cultivation of, in Upper Canada, xxxiii.

——— for the importation of the greatest quantity of marketable, the produce of Canada, Nova-Scotia, and New Brunswick, xxxiii.

Herrings, for exporting British-cured, xxx.

Kali for Barilla, for the cultivation of the greatest quantity in the Bahama islands, xxxii.

Mackarel, for curing the greatest quantity of, xxxii.

Nutmegs, for the greatest quantity of merchantable, equal to those imported from the islands of the East Indies, xxxii.

Digitized by Google

Premiums for Commerce, &c., continued, viz:

Oil from Porpoises, or Sun Fish, for the manufacture of the greatest quantity of, xxx.

Olive Oil, for the importation of the finest specimen of, xxxiv.

Silk, for raising in any British Colony, and importing, the greatest quantity of, xxxiii.

Taking Porpoises, for taking the greatest number of Porpoises on the Coast of Great Britain or Ireland, for the purpose of extracting Oil from them, xxx.

Trees, for the best method of extirpating the Stumps and Roots of, xxxv.

True Cochineal, for the importation of the greatest quantity of, xxxv.

Wine from the Cape of Good Hope, for the importation of the finest Wine, made from the produce of Vineyards at the Cape of Good Hope, xxxiv.

—— *from New South Wales,* for the importation of the finest Wine, made from the produce of Vineyards in New South Wales, xxxiv.

Wool from New South Wales, for the importation into Great Britain or Ireland, the greatest quantity of, xxxiv.

——————————, for the finest sample of, xxxiv.

Premiums in Chemistry, Dyeing, and Mineralogy, xii to xviii.

Acid, Sulphuric, from Sulphur, without the use of Nitric Salt, for the preparation of the largest quantity of, xiii.

Arsenic, for the discovery of a superior Test for Arsenic in Solution, xii.

Artists, for the production of a Permanent White Paint, for the use of, xvii.

Brass, for a method of making, xiii.

British Indigo, for a preparation of,

Candles, for an economical mode of hardening or otherwise preparing Tallow, xv.

Digitized by Google

Premiums in Chemistry, Dyeing, and Mineralogy continued, viz:

Coal Gas, for the discovery of the cheapest method of purifying the inflammable Gas procured from Coal, xiii.

Copper from the Ore, for a method of separating, purifying, and refining, xiii.

Cotton Cloth, for a preparation of a green colour for printing, xvii.

——— for a preparation of a Red Stain for, xvii.

Crown Glass, for making Crown or Window Glass equally transparent, and as free from blue and green colour as the best German Sheet, xiv.

Crucibles, for a process for manufacturing improved Earthenware, xiii.

Dyeing Silk of a Pink or Rose Colour, for the discovery of a process for, xvi.

——— *or Woollen*, for the discovery of a superior method of, xvi.

——— *with Lac Lake*, for a process for, xvii.

——— *Silk or Wool*, for a black dye for, xvii.

Flint Glass, for making, free from veins, and as dense and transparent as the best now in use, &c. xiv.

Gas, for the discovery of the cheapest method of purifying Coal, xiii.

Glass, for the making of Crown or Window Glass equally transparent, and as free from blue and green colour as the best German Sheet, xiv.

——— for making Flint Glass free from veins, and as dense and transparent as the best now in use, &c. xiv.

Green Colour for Printing Cotton Cloth, for a preparation of a, xvii.

History, for the Publication of the Natural, of any County in the United Kingdom.

Indelible Ink, for a superior method of making, xiv.

Ink, for a superior method of making Indelible, xiv.

——— for the best composition for Printing, xiv.

——— for the best composition for Copper Plate Printing, xiv.

Digitized by Google

Premiums in Chemistry, Dyeing, and Mineralogy continued, viz.

Ireland, for the completion and publication of the most accurate Mineralogical Map of, xviii.

Iron, for making the greatest quantity of fine Bar, xiii.

—— *Wrought*, for a cheap composition, superior to those in use, for the preservation of, from rust.

Lac Varnish, for the production of a colourless, xviii.

Leather Water Proof, for a superior method of rendering, xiv.

Lithography, for the discovery of a Quarry of Stone, within Great Britain or Ireland, fit for the purposes of, xviii.

Maps, for the completion and publication of the best Mineralogical and Geological County, xviii.

Mineralogical County Maps, for the completion and publication of the best, xviii.

———— *Map of Ireland*, for the completion and publication of the most accurate, xviii.

———— *Map of Scotland*, for the completion and publication of the most accurate, xviii.

Moths, for the cheapest, most easy, and effectual method of preventing the destructive effects by, xv.

Natural History, for the publication of any County, in the United Kingdom, xviii.

Oil for Chronometers and Watches, for the invention and discovery of the best method of distinguishing the fittest, xiv.

Ores, for the most effectual method of preventing the ill effects of smelting, xii.

Paint, for the best substitute for the basis of White, xvi.

——— for the production of a Permanent White, for the use of Artists, xvii.

Pipes, for a substitute for Lead, xv.

Preparation of Tan, for a preparation in the most concentrated form, xvi.

Preserving Seeds of Vegetables, for the best method of, xv.

Digitized by Google

Premiums in Chemistry, Dyeing, and Mineralogy continued, viz:

Preserving Iron from Rust, for a cheap composition for, xv.

——— *Salted Provisions from becoming Rancid or Rusty*, for the discovery of a method of, xv.

Preventing the Dry Rot in Timber, for the discovery of a certain method of, xv.

——— *the Destructive effects from Moths*, for the discovery of a cheap method of, xv.

——— *the Mildew in Paper*, for communicating a process for, in the manufacture of, xv.

Red Pigment, for a satisfactory process for preparing, xvii.

—— *Stain for Cotton Cloth*, for a preparation of, xvii.

Refining Zinc from the Ore, for the discovery of a superior process to any hitherto known of, xiii.

——— *Whale or Seal Oil*, for disclosing an effectual method of purifying Whale or Seal Oil, xiii.

Salted Provisions from becoming Rancid or Rusty, for the discovery of the best, cheapest, and most efficacious method of preserving, xv.

Scotch Fir, or Pinus Sylvestris, for the greatest quantity of Turpentine from, xvi.

Scotland, for the completion and publication of the most accurate Mineralogical Map of, xviii.

Silk, for a process of dyeing Rose and Pink colours, xvii.

Smoke, for the best and easiest means, superior to any now before the public, of preventing the emission of dense Smoke from the Chimnies of Steam Engines, &c, xii.

Statuary Marble, for the discovery of a Quarry of, xvii.

Steam, for a method of increasing, xii.

Stone for Lithography, for the discovery of a Quarry of Stone, within Great Britain or Ireland, fit for the purposes of Lithography, xviii.

Substance for the Basis of White Paint, for the best, xvi.

Tallow Candles, for a method of hardening, or otherwise preparing, to be afforded at a less expense than those made with Spermaceti, xv.

Digitized by Google

Premiums in Chemistry, Dyeing, and Mineralogy continued, viz:

Tan, for a preparation of, xvi.

Tar, for the invention of a substitute for, xvi.

Timber, for the discovery of a certain method of preventing the Dry Rot in, xv.

Turpentine from the Scotch Fir, or Pinus Sylvestris, for a preparation of the greatest quantity of, xvi.

Ultra-marine, for the preparation of an Artificial, xvii.

Varnish, for the production of a colourless Lac, xviii.

Vegetables, for the best method of preserving Seeds of Plants in a state fit for vegetation, xv.

Whale or Seal Oil, for an effectual method of purifying, xiii.

Wrought-Iron from Rust, for a cheap composition, superior to those in use, for preserving, xv.

Premiums for Encouraging and Improving Manufactures, xxvi to xxviii.

Cat-Gut, for a discovery of the best method of manufacturing, xxvii.

Cloth from New South Wales Wool, for the manufacture of the finest Specimen, at a fair market price, of, xxvii.

Gloves, for making known a process equal, or superior to that of the French, for preparing, dyeing, and finishing the Skins for, xxvii.

Hose for Fire Engines, Brewhouses, &c. for the invention of a method of making, xxvii.

Machines for Silk Weaving, for the invention of a Machine to weave figured Silks, xxviii.

Organzine Silk, for a method by which to Organzine Silk equal in quality to the Italian Throw, xxviii.

Paper, for the discovery of a method of making Transparent, xxvii.

Preventing the Watering of Plain Silks, for a method of, xxviii.

Digitized by Google

Premiums in Manufactures continued, viz.:

Ribbons, for the best substitute for the plan now used in the single-hand Loom, xxviii.

Sheep's Wool, for the sale of the largest quantity of Merino, or such Wool as will answer the same purpose, xxvi.

Silks, for a method of preventing the watering of Plain, xxviii.

Thread for Lace, for inventing or discovering a method of manufacturing, xxvii.

Transparent Paper, for a method of making from the pulp, xxvii.

Weaving Ribbons in the Single-Hand Loom, for the best substitute for the plan now used in the, xxviii.

Wicks for Candles, for the most satisfactory result of experiments to determine the best thickness of cotton for, xxvi.

Premiums in Mechanics, xxviii to xxxi.

Carriages, for the invention and discovery of a method of preventing accidents from horses falling with two-wheeled, xxx.

Coaches, for the invention and discovery of a method of preventing accidents from Stage, xxx.

Coals, Ore, &c., &c., for the invention of a Machine for raising, xxix.

Family or Portable Mill, for the invention of the best constructed, xxviii.

Fires, for the best and most effectual method of extinguishing, xxix.

Gunpowder Mills, for so constructing, as to prevent explosion in, xxviii.

Heating Rooms for the Purpose of Manufacturers, for the invention and discovery of a superior method of, xxix.

Improved Ventilation, for the discovery of a method superior to any now known or used, xxix.

——— *Walking-Wheel or Crane*, for an improved, xxix.

Digitized by Google

Premiums in Mechanics continued, viz.:

Machine for Raising Water, for the invention of a better, cheaper, &c., than any hitherto known, xxix.

Mill for Grinding Corn, for the invention of a Family or portable, xxviii.

Needles, for the invention and production of a mode of obviating the prejudicial effects that attend the operation of pointing, xxx.

Raising the Bodies of Persons who have Sunk under Water, for a cheap and portable Drag for, xxx.

Roads, for the most effectual and cheapest method of improving Turnpike and other, xxx.

Rocks, for a more simple, safe, cheap and expeditious method of boring and blasting, xxix.

Screw, for producing an original, xxx.

Steam Engine and other closed Boilers, for a method of preventing explosion in, xxx.

———, &c., for the best working Drawings in Plan, Elevation, and Section of a Condensing Steam Engine, in its most improved state, &c., xxx.

Ventilation, for the production of a mode of permanently Ventilating Apartments in Hospitals, Workhouses, &c., superior to any now known or used, xxix.

——— *of Coal Mines*, for effectually preventing the accidents liable to arise from the accumulation of carburetted hydrogen and other gases, xxix.

Walking Wheel or Crane, for the invention of an improved, xxix.

Water, for a machine for raising, on a better, cheaper, and more simple construction than any hitherto known, &c., xxix.

———, for the invention and production of a superior, cheap, and portable Drag, for raising the bodies of persons sunk under, xxx.

Premiums in Polite Arts, xix to xxi.

——— for Artists and others, xxii to xxv.

Anatomy of the Human Body, &c., for the best original drawing of, xxv.

Digitized by Google

Premiums in Polite Arts continued, viz.:

Animals, for the best drawing of, xxiii.

Architecture, for the best perspective drawing of a Corinthian Capital, xxiv.

Artists and others, Premiums for, xxii.

Carving in Wood, for the best, of fruit or flowers, xxiv.

———, for the best, of animals, xxiv.

———, for the best, of one or more human figures, xxiv.

Conditions in, xxvi.

Design for a Vignette, for the best, xxiv.

Drawing, for the best original, xxiv.

———, for the best copy of, xxiv.

Enamel Painting, for the best enamel painting of a head, xxiv.

Engraving on Steel, for the best specimen of, xxv.

——— *on Wood, or Metal Blocks*, for the best Engraving on, xxv.

Etching, for the best Etching in historical composition, xxiv.

———, for the best, of a Landscape, xxiv.

Finished Engravings, for the best in historical composition, xxiv.

———, for the best, of a Landscape, xxv.

———, for the best, of a Portrait, xxv.

———, for the best, of a Portrait in mezzotinto, xxv.

———, for the best, not included in any of the preceding classes, xxi.

Flowers, or Fruit, Premiums for the best drawings, &c. of, xxiii.

Heads of Portraits, Premiums for the best drawings, &c. of, xxii.

Honorary Premiums for Gentlemen and Ladies, xix.

Honorary Premiums for Nobility, xix.

Human Figure, for Drawings, Outlines, Copy in Oil, and original Painting, &c. of the, xxii.

Digitized by Google

Premiums in Polite Arts continued, viz.:

Landscape, Premiums for the best drawing, &c., of, xxiii.

Lithography, for the best specimen of, xxv.

Medal Die Engravings, for the best, of a single figure, &c., xxv.

———, for a method of hardening, xxv.

Medical or Surgical Students, Premium for, xxv.

Models, Premiums for the best, xxii.

Oil, for the best original Painting in, &c., xxiii.

——, for the best copy in, xxiv.

Perspective, for the best perspective Drawing of any public building in the United Kingdom, xxiv.

Prevention of Forgery, for the best method of preventing the impressions of prints from being transferred from the Paper, &c., xxv.

Still Life, for the best original composition painted in oil or water colours, &c., xxiii.

Water-colours, for the best original painting in, xxiv.

———, for the best copy in, xxiv.

Presbury, Mr. G., the Large Silver Medal to, for a drawing in Chalk, xxxviii.

Pritchard, Mr. W., the Thanks of the Society to, for his Communication of a new material for Hats, 228.

Purser, Mr. C., the Large Silver Medal to, for an architectural Drawing, xxxix.

R.

Radclyffe, Miss M., the Silver Palette to, for an Etching of a Landscape, xxxix.

Raine, J. Esq., the Silver Ceres Medal to, for opening a market for the Wool raised in the Settlement of Van Diemen's Land, &c., xi; his Communication respecting, 237.

———, the Large Silver Medal to, for importing Sea-elephant oil, xi; his Communication respecting, 238.

Digitized by Google

Ranson, Mr. T. F., the Gold Isis Medal to, for a finished historical Engraving, xxxix.

Rat Trap, Mr. Bowler's explanation of his, 154.

Reveley, Mr. H. W., the Large Silver Medal to, for his Communication respecting Stones used in Tuscany, for Grinding fine Flour, xxxix; his Communication respecting, 47.

Richards, Mr. E., Twenty Guineas to, for his improvement in the Silk-weaver's Draw-boy, xxxix; his Communication respecting, 181.

Richardson, Miss, the Silver Palette to, for a copy in Chalk, xxxviii.

S.

Savage, Mr. G., the Large Silver Medal to, for a Detached Escapement, xi; his Communication respecting, 151.

Seabrook, Miss S. S., the Silver Palette to, for a copy in Chalk, xxxviii.

Shaw, Miss L. A., the Large Silver Medal to, for a painting in water colours, xxxvii.

Ship's Compass, Lieut. R. P. Littlewort's Communication on a, 70.

Ship's Place on a Chart, Mr. E. Wigzell's Communication on an Instrument for marking a, 158.

Simpson, Miss J., the Silver Palette to, for a copy in Chalk, xxxviii.

Simpson, Mr. P., the Silver Isis Medal, with a Gold Rim, for a copy in oil, xxxvii.

Smith, Miss, the Silver Isis Medal to, for a Miniature, xxxviii.

——, the Large Silver Medal to, for a copy of a Miniature, xxxviii.

——, Miss A., the Silver Palette to, for a copy in Chalk, xxxviii.

——, Miss J., the Large Silver Medal to for a Landscape, xxxvi.

——, Mr. O., the Large Gold Medal to, for a Model in Plaster, xxxix.

——, Mr. T., the Large Silver Medal to, for a Model in Plaster, xxxix.

Digitized by Google

Starkey, Mr. T., the Gold Isis Medal to, for fine Broad Cloth, made of Wool from New South Wales, xxxix; his Communication respecting, 230.

Steam Boilers, Mr. Hall's Communication on a Self-acting Apparatus for supplying Steam Boilers with Water,

T.

Taylor, Mr. E., the Gold Isis Medal to, for an Architectural Design, xxxix.

Taylor, Mr. J. F., the Silver Isis Medal to, for a Pencil Drawing, xxxvii.

Theed, Mr. W., the Silver Isis Medal to, for a Model in Plaster, xxxviii.

Thom, Mr. R., the Large Silver Medal to, for an Hydraulic Apparatus, xi; his Communication respecting, 81.

Thompson, Mr. J., the Gold Vulcan Medal and Fifty Guineas to, for an Improvement in the Silk Ribbon Loom, xxxix; his Communication respecting, 195.

Turner, Miss J., the Silver Palette to, for a Copy in Pencil, xxxviii.

Turner, Mr. R., the Silver Isis Medal to, for a Portrait in Oil, xxxvi.

Turnips, Messrs. Cowley and Staines, method of preserving during the Winter, 29.

Turret Clocks, Mr. W. Wynn's Communication on an Improved Hammer for, 105.

Tuscany, Mr. H. W. Reveley's Communication respecting the nature and preparation of the Stones used in, for Grinding Fine Flour, 47.

V.

Van Diemen's Land, Communication on opening a Market for the Wool raised in the Settlement of, 237.

W.

Watson, Mr. J., the Silver Vulcan Medal to, for a System of Musical Notation, xi; his Communication respecting, 78.

Watts, Mr. F. W., the Silver Isis Medal to, for a Landscape in Oil, xxxvi.

Digitized by Google

Watts, Mr. F. W., the Gold Isis Medal to, for a Landscape in Oil, xxxvii.

——— Mr. H. W., the Silver Isis Medal to, for a Composition in Oil, xxxvii.

Wells, Mrs., (See *Woodhouse.)*

White, Mr. T. D., the Silver Palette to, for a Copy in Chalk, xxxviii.

Wigzell, Mr. E., the Large Silver Medal to, for marking a Ship's place on a Chart, xi; his Communication respecting, 158.

Williams, Mr. E., the Silver Palette to, for an Outline, xxxviii.

Windows of Churches, &c., Mr. W. Bailey's Communication on an Improved Method of Opening and Shutting, 173.

Wood, Mr. J., the Gold Isis Medal to, for a Model in Plaster, xxxix.

Woodhouse, Miss Sophia (now *Mrs. Wells,)* the Large Silver Medal and Twenty Guineas to, for a new Material for Fine Plat in Imitation of Leghorn; Communication respecting, 217.

Wrought-Iron Gun Carriage, Mr. R. Pering's Communication respecting, 54.

Wynn, Mr. W., Twenty Guineas to, for an Improved Hammer for Turret Clocks, xi; his Communication respecting, 105.

Z.

Zeigler, Mr. H. B., the Gold Medal to, for a Landscape in Oil, xxxvii.

Digitized by Google

ERRATA ET CORRIGENDA, in Volume XXXIX.

Page 50, *line* 11, *for* "from the extremity of *d*," *read* "from the extremity *e* of the arc *c d e*,"
—— 53, — 5, *from bottom*, *for* "24 pounder above mentioned," *read* "24 pounder mentioned in my Essay."
—— 61, — 3, *for* "crached," *read* "cracked."
—— 84, — 5, *from bottom*, omit †.
—— 87, — 4, *from bottom*, *for* * *read* †.
—— 98, — 20, *for* "time," *read* "line."
—— 106, — 6 *from bottom*, *for* "23rd" *read* "22nd."
2 *from bottom*, *for* "22" *read* "20."
—— 107, — 2, *for* "in the line of small figures, parallel to the former" *read* "in the small figures contained between the same horizontal lines as the former."
—— 115, — 16, *for* "parison" *read* "comparison,"
—— 127, — 6, dele, "or syphon."
—— 130, — 2, *from bottom*, *after* "state" *add* "fig. 3 is a front, and fig. 5, a back view."
—— 131, — 14, *for* "end" *read* "ends."
—— 141, — 16, *for* "oil" *read* "steel."
—— 173, — 4, *for* "or" *read* "of."

In the description of Mr. Perkins's Orthometer and Pleometer, pages 127 and 128, the two instruments are in some measure confounded with each other: the distinction between them is as follows. The Orthometer has an adjusting screw *o*, by which the position of the level can be adjusted, so that the indexes shall be always in a line when the vessel is in proper trim.

The Pleometer has a permanent position, and the inclination of the vessel is inferred from the deviation of the indexes from the center or horizontal line.

The Orthometer is more sensible to slight changes in the inclination; the Pleometer is constructed to exhibit a greater range of variation.

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ANALYTICAL INDEX.

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AN

ANALYTICAL INDEX,

&c. &c.

VOL. XXVI TO XL.

ABRAHAM, Mr. J. C., on a Magnetic Guard for Dry-grinders, xl 135

Ackerman, Mr. R., on a Portable Lithographic Press, xxxvii 131

Acorns, Land Sown with, by C. F. Palmer, Esq., M. P., xxxix 30

Address by the Secretary at the distribution of Premiums, 27th May, 1817, xxxv 209.

Agricultural Instruments.

Double-drill Turnip Sower, by Mr. J. Common, xxxvi 24

Plough, turnwrest, by Mr. James Wilkinson, xxxii 38

Plough-screw, adjusting, by Mr. T. Balls, xxviii 45

Expanding Harrow, by Mr. W. Jeffrey, xxviii 51

Instrument for eradicating Docks and Thistles, by Mr. Baker, xxviii 50

Reaping-hook, by Mr. Joseph Hutton, xxviii 54

Threshing Machine, by Mr. Lees, xxviii 25

Improved Dibble for Acorns, by C. Waistell, Esq. xxix 60

Ainger, Mr. A., on a Self-adjusting Crane, xxxvii 124

..... on a Spring-latch, xxxviii 111

..... on a Correctional Scale for Temperature, applied to the Hydrometer, xl 160

Ainslie, Dr. H., on planting Forest Trees, xxx 25

Allan, Mr. J., on an Improved Mathematical Dividing Engine, xxviii 179

..... on a Reflecting Circle, xxix 106

..... on a Theodolite, xxxiv 206

..... on an Instrument for cutting Screws, xxxiv 207

..... Grant of 100*l.* to, by the Board of Longitude, xxxviii 203

..... on an Engine for Cutting the Divisions on Circular Arcs, xxxix 142

Allason, Mr. T., on a Reticulated Square for Drawing, xxxiv 145

Anatomical Preparations, use of Salt in preserving, by W. Cooke, Esq. xxxvii 43

Anchors, Improved Construction of, by Captain H. L. Ball, R. N. xxvi 170

Digitized by Google

Anchors, Double Hook, for Fishing, by Captain H. L. Ball, R. N. xxvi 170

..... *Cast Iron Mooring-block*, by Mr. S. Hemman, xxviii 170

..... by Mr. J. Park, xxxvi 84

Anderson, Alexander, M.D. on the economical Use of certain Plants, Natives of the West Indies, xxvi 234

..... Table of the Growth of certain Trees in the Botanic Garden at St. Vincent's, xxvi 240

..... on the Cultivation of Black Pepper at St. Vincent's, xxvii 228

..... on Nutmegs in St. Vincent's, xxviii 313

..... on Sago produced at St. Vincent's, xxx 212

..... Mr. W., on a Method of Painting on Canvas in Oil Colours, xxvi 135

..... on the Culture of Mountain Rice, &c., xxxix 169

Andrews, Henry, Esq., on Planting Oaks, xxix 30

Angulometer. See *Painting and Drawing*

Anvil, Improved Mode of Constructing, by Mr. R. King, xxxviii 78

Arches, groined. See *Architecture*.

Architecture and Building.

Arches, Method of removing the Centering of, by Mr. R. Williams, xxxiii 127

Arches, groined, on Constructing the Ribs of, by Mr. Jos. Jopling, xxxviii 86

Bricks, Mr. Stephen's Method of Making, xxix 39

Bow and String Rafter, by Mr. George Smart, xxxvii 100

Roofs, on the Construction of, by A. H. Holdsworth, Esq., xxxviii 62

Scaffold, Temporary, for the Interior of Domes, by Mr. G. Hughes, xxxi 203

..... Temporary, by Mr. Jos. Davis, xxx 168

Arcograph. See *Painting, &c.*

Arm, Apparatus for those who have lost an, by Captain Stack, xxxviii 121 (See also Hand)

Arts, Polite. See *Painting*

Assalini, P., the Chevalier, on Surgical Instruments, xxxiii 93

Astronomical and Surveying Instruments.

Allan's, Mr. J., Reflecting Circle, xxix 106

..... Theodolite, xxxiv 206

Byron's, Mr. L., Sinical Octant, xxxii 111

Hardy's, Mr. W., Inverted Spring Pendulum, xxxvii 147

Taylor's, Mr. T., Repeating Alarum, xxxvii 151

Aubery, Mr. L, on a Machine for Cutting Leather Straps, xxviii 192

Aust, Mr. W., on a Lever for raising the Shafts off a fallen Horse, xxxv 158

....on a Lifting Pump, xxxvii 133

Austen, Mr. T., on a Method of Adjusting the Bed-stone of Corn Mills, xxxviii 65

Austin, J. Esq., on Embanking from the Sea, xxx 32

Axle of Wheel Carriages. See *Wheel Carriages*.

Baader, the Chevalier, on a Method of communicating Rotatory Motion, xxxiv 193

Backhouse, E., Esq., on Planting Larches, xxxii 32

..... Jon. jun. Esq., on Planting Larches, xxxi 70

..... W., Esq., on Planting Larches, xxxi 67

Bagnold, Captain T. M., on a Method of Elevating or Depressing Ships' Guns, xxix 91

..... on a Temporary Ship's Rudder, xxxv 185

..... on a Cartouch Box for Naval Service, xxxvii 79

Digitized by Google

Bailey, Mr. W., on a Mode of Opening and Shutting Church Windows, xl 173

Bain, A., M. D., on Planting Forest Trees, xxvi 41

.... on Planting Firs, xxix 25

Baker, Mr. Ez., on Improvements in Fire Arms, xxviii 199

..... on a Bullet Mould, xxxix 101

..... on a Regulating Screw for the Mainspring of Fire Arms, xl 118

..... Mr. J., on an Instrument for eradicating Docks and Thistles, xxviii 50

..... Mr. J., on purifying Whale Oil, xxxiii 65

Ball, Captain H. L., R. N., on Improved Anchors, &c., xxvi 170

Ball-cock. See *Cock*

Ballasting Ships. See *Ship Building*, &c.

Balls, Mr. Thomas, on a Screw Adjusting Plough, xxviii 45

Balluster. See *Hand-rail*

Barber, Mr. T., on an Instrument for Measuring and Laying down Angles, xxxiv 150

Barchard, Mr. R. W., on a Cylindrical Traversing Rake, xxxv 152

Barlow, Mr. P., on an Apparatus for Correcting the Local Variation of the Compass on Board Ship, xxxix 76

Barlow, Mr. W., on an Improved Screw Wrench, xxvi 199

Barrallet, Mr. S., his Shop-Board for Tailors, xxxi 147

Barraud, Mr. J., on a Violoncello, xxxvii 67

Barrow, Mr. J., on a Double Door Spring, xxxiii 146

..... on a Single Door Spring, xxxiii 148

Bath, Vapour, &c., by Dr. Cumming, xxx 181

Baugh, Mr. Robert, his Map of Shropshire, xxvii 109

Beacon, Life. See *Life-Beacon*

Beard, Mr. Joseph, his Machine for Crooking and Cutting Wire for Cards, xxx 119

Beckway, Mr. C., on a Machine for Weighing and Binding Trusses of Hay, xxxvii 15

Bed, for Surgical Patients, by Henry Earle, Esq., xxxix 113

Bedstead, for Invalids, xxix 118

..... for the Sick and Infirm, by Mr. J. Woodall, xxxii 105

Bees, Twenty-one Stocks in the possession of Mr E. Knight, xxxi 79

.... Management of, by Is. Espinasse, Esq., xxxvi 29

Behnes, Mr. W., on an Instrument for Transferring the Points in Sculpture, xxxvii 172

Bell, Mr. A., on an Universal Chuck for Turners, xxxvii 85

Biddle, Mr. Ar., on a Hay Borer, xl 36

Binnacle, Ships', and Lamp, by Mr. G. Preston, xxxi 188

Bishop, W. and Co., on the Discovery of a Quarry of Fine Millstone, in Halkin Mountain, Flintshire, xxxix 55

Bistoury. See *Surgical Instruments*

Blind, Mr. Cooke's Apparatus for Teaching Music to the, xxx 143

Block, for Calico Printers. See *Calico Printers*

..... Mooring. See *Ancho*

Blowing-machine, for Smiths and Founders, by Messrs. Jeffries and Halley, xxxviii 87

Blowpipe, for Enamellers, &c., by Mr. J. Tilley, xxxi 106

Boat, Life. See *Shipwreck*

Boats, Timbers and Knees for. See *Ship Building*

Digitized by Google

Boilers, Mr. Webster's Method of getting rid of the Steam from, xxix 145

Bolton, Captain William, R. N., on Improved Jury Masts, xxvi 167

..... on his Method of Setting up the Shrouds and Lower Rigging of Ships, xxvii 139

Boot and Shoemakers, Mr. King's Instrument, for the use of, to enable them to work standing, xxx 173

..... Mr. Coad's, Do. xxxv 160

Boringdon, Lord, on Embanking Land from the Sea, xxvi 30

Bouchette, Lieut. Col., on a Map of Canada, xxxiv 245

Bowden, Amb. Esq. on the Prevention of Dry-rot in Ship-timber, xxxvi 53

Bowler, Mr. S., on a Rat-trap, xl 154

..... Mr. W., on an Apparatus for drying Grain, xxxiii 47

..... on a Rat-trap, xxx 154

Boyce, Mr. T., on a Life-boat, xxxii 177

Brabazon, W. Esq. on a Rowlock, xxxvii 83

Braby, Mr. Jas., on a Cart and Drag, xxxii 45

..... on a Weighing Machine, xxxiii 150

..... on a Fire-escape, xxxiv 227

Bradshaw, R. H. Esq. M. P. on Reclaiming Peat-moss, xxxvi 1

Braithwaite, Mr. M., on Planting Forest-trees, xxx 96

Bramah, Messrs., their Hydro-mechanical Oil Press, xxxiv 261

Brandt, Mr. C., on a Spring Crutch for Pendulums, xxxix 108

Bray, Mr. Gab. on a Life-boat, xxxv 172

Bread, composed of Wheaten flour, and Potatoes. By H. B. Way, Esq. xxx 105

..... of Wheaten flour, and Potatoes, Experiments on, xxxi 55

Bream, Mr., on a Boiler for Tallow chandlers, xxvii 198

Bremner, The Rev. Jas., on a method of converting a Ship's-boat into a Life-boat, xxviii 135

..... on a Night Telegraph, xxxiv 213

..... on a Day Telegraph, xxxiv 222

..... Mr. W., on an Instrument for the Extirpation of Polypi, xxxiv 184

Bricks. See *Architecture*

Bridgen, Mr. R. on a Head-piece for Gilders, xxix 138

Bridle-bit, an Improved, by Mr. C. Goodwin, xl 66

Brierly, Mr. S., on a Stretch for the Warp of Woollen-weavers, xxxvi 57

British Opium. See *Opium British*

Brockbank, Mr. J., on a Machine for making Slate Pencils, xxvii 175

Brunton, Mr. W., on a Pump for Well-sinkers, xxix 98

Buck, Mr. J., on an Instrument to examine the State of Ships' Bottoms at Sea, xxxiii 124

Bucke, G. Esq., on Pure Merino Wool grown in England, xxxiv 155

Bullet-mould, an Improved, by Mr. Ez. Baker, xxxix 101

Bullock, Mr. W., on a Service-pipe for Cisterns, xxxviii 57

Bullrushes, for Chairmakers, on the Culture of, by Mrs. H. D'Oyly, xxxv 44

Bulls, Vicious, Apparatus for, by H. J. Nicholls, Esq. xxxvii 42

Bull's-eye, and Ventilator for Ships. See *Ship-building*, &c.

Bullock, Mr. W., on a Spring-clip for Screens, xxxvii 92

Burrows, Robt. Esq., Experiments on the Culture of Wheat, xxvi 93

Busby, Mr. C. A., on a Hydraulic Orrery, xl 98

Digitized by Google

Butler, J. Esq., on the Improvement of Waste Land, xxvi 117

Butter, preserved from becoming Rancid, by Mr. A. Hodge, xxx 87

Byron, Mr. L., on a Sinical Octant, xxxii 111

Cabbages, Culture of, by J. C. Curwen, Esq. M. P., xxvi 79

Calico printers' Block, by Mr. H. Marshall, xxxii 85—xl 178

Callender, Mr. Jas., on Seasoning Mahogany, xxxv 71

Caloe Hemp, Capt. Jas. Cotton, on the Culture of, &c. xxxiii 162—xxxix 167

Canada, Map of. See *Map*

Cannon, Capt. Bagnold's Method of Elevating and Depressing, xxix 91

..... Mr. N. Douglas's Instrument for Firing, xxxi 211

Cannon, Ships', Mr. A. Law's Method of Securing, xxxiii 122

Canvas, Method of covering with Oil Paint, by Mr. Wm. Anderson, xxvi 135

..... Specimens of, for the Use of the Navy, by Mr. S. Hood, xxxiv 165

..... Naval, made by Messrs. Cayme, xxx 139

Caoutchouc from Bengal, xxx 191

Capstan, Method of Working, by Lt. Shuldham, xxxiv 198

Cards, Mr. Beard's Machine for crooking and cutting Wire for, xxx 119

Carriages. See *Wheel Carriages*

Carrots, preserving through the Winter, by H. B. Way, Esq., xxxiii 45

Cart and Drag, by Mr. Jas. Braby, xxxii 45

Cartouch-box, for Naval Service, by Capt. T. M. Bagnold, xxxvii 79

Cartwright, the Rev. Edm. D.D. on a Traversing Apparatus, xxxiv 177

..... on Burnt Clay, as a Manure, xxxvi 9

Casks, empty, Plug for raising, by Lieut. Rodger, xxxvi 100

Caslon, Mr. W., on a Gas lamp, xxx 162

Cathery, Mr. R. D. on a Method of Preparing Ox-gall for the use of Painters, xxviii 106

..... on a Method of Fixing Chalk Drawings xxx 111

..... on Transparent Paper, xxx 116

Cattle, hoven, cure of, by Mr. W. W. Mason, xxvi 128

..... on Stall Feeding, by J. C. Curwen, Esq. M. P., xxviii 33—xxxii 56

..... Milch-cows, fed on Steamed Food, by J. C. Curwen, Esq., M. P. xxx 58

..... Fattening, Experiment on, by J. C. Curwen, Esq. xxxiv 48

Cawood, Mr. M., on a Mode of connecting Water Pipes, xxxiv 244

Cayme, Messrs. R. and G., on Naval Canvas, equal to the best Dutch, xxx 139

Center-bit, Expanding, by Mr. James Stone, xxxi 250

Centro-linead, (Instrument for Drawing in Perspective), by Mr. P. Nicholson, xxxii 67—xxxiii 69

Chain-beams. See *Ship-building*

Chalk Drawings. See *Drawings*

Charcoal, Method of Preparing for Drawing with, by Mr. C. Pye, xxxiv 129

Chart, Instrument for marking a Ship's Place on a, by Mr E. Wigzell, xl 158

Chemical Hydro-pneumatic Apparatus, by Mr. J. Cuthbert, xxxvii 106

Cherry, Mr. F. C., on Improved Blocks and Springs for Wheel Carriages, xxxviii 93

Chimnies, Mr. Roberts, on a Machine for sweeping, xxvii 209

..... by Mr. C. Wilson, xxxv 184

Digitized by Google

Chimnies, Apparatus for Sweeping, by Mr. W. Feetham, xxxvii 128

..... by Mr. J. Skinner, xxxviii 73

Chimney-sweeping, Method of obviating the Necessity of, by the Rev. T. Rudge, xxxiii 131

Chromate of Iron, discovered in Shetland, by Dr. Hibbert, xxxviii 23

Chuck for Turners. See *Turners*

Churn-staff, Swivel-headed, by Mr. T. Fisher, xxvi 131

Churn, by Mr. W. Sampson, xxx 95

..... with two Beaters, by Mr. E. Roberts, xxxvii 40

Circle, Reflecting. See *Astronomical Instruments*

Circular Arcs, Engine for Cutting the Divisions on, by Mr. Jas. Allan, xxxix 142

Cisterns, a Service Pipe for, by Mr. W. Bullock, xxxviii 57

Clague, Miss Anne, on raising New Potatoes through the Winter, xxxii 62

Clanny, R. M.D., on a Safe Lamp for Collieries, xxxiv 121

..... on a Steam Safe Lamp for Collieries, xxxv 75

Clark, Mr. Bracey, on Hobbles for Horses, xxxiii 140

Clay and sods, method of Burning by means of Quick Lime, by J. C. Curwen, Esq., xxxiv 51

Clay, burnt, use of as a Manure, by the Rev. Edm. Cartwright, D.D. xxxvi 9

Clegg, Mr. S. on his Apparatus for making and burning Coal Gas, xxvi 202

Cleghorn, Mr. T. on a Buoyant Line, xxxii 181

Clement, Mr. Jos., on an Instrument for describing Ellipses, xxxvi 133

Clip, Spring, Mr. Bullock, on a, xxxvii 92

Clock and Watch:—

Three-wheeled Clock, by Mr. Jas. Fayrer, xxxvii 138

Striking part of a Clock, by Mr. John Prior, xxix 149—xxxv 138—xxxviii 59

Compensation Pendulum, by Mr. A. Reid, xxviii 230

..... by Mr. D., Ritchie, xxx 176

Timekeeper and Compensation Pendulum, by Mr. W. Wynn, xxxv 127

Method of communicating Motion to a Pendulum, by Mr. D. Ritchie, xxxvi 114

Spring Crutch for Pendulums, by Mr. C. Brandt, xxxix 108

Equation Work, by Mr. H. Ward, xxxii 144

Escapement for Pendulum Clocks, by Mr. G. Prior, xxvii 200—xxix 133

Detached Escapement for a Clock, by Mr. W. Hardy, xxxviii 165

Detached Escapement, by Mr. G. Savage, xl 151

Hammer for Turret Clocks, by Mr. W. Wynn, xl 105

Noctuary, by Mr. Spark, xxviii 234

Pitching, or deepening Tool, by Mr. W. Hardy, xxxviii 181

Rate of Going, of Mr. Hardy's Timekeeper, xxxix 175

Cloth, from Nettles, xxix 81

Coach, Safe, by Mr. O. Elliott, xxxviii 143

Coad, Mr. F., on an Instrument to enable Shoemakers to work Standing, xxxv 160

Coal, Mr. B. Cook's Apparatus for Distilling, xxviii 73

Coal Gas, Mr. S. Clegg on, xxvi 202

Coape, Hen. Esq., on Embanking Land from the Sea, xxxiii 36

Cochrane, Major Spenser, on Furze, as a Food for Horses, xxvii 77

Cock, Ball, on a, by Mr. Jos. Farey, xxxv 175

Digitized by Google

Cocks, Lock for, by Mr. W. Russell, xxxvii 94

..... Mr. Williams's Machine for Boring, xxvii 196

Cocoa-nut Oil. See *Oil*

Coffer, for Repairing Ships afloat. See *Ship-building*

Collieries, Dr. R. Clanny's Safe Lamp for, xxxiv 121—xxxv 75

..... System of Ventilation for, by Mr. Jas. Ryan, xxxiv 94

Common, Mr. J., on a Double-drill Turnip Sower, xxxvi 24

Compass, Method of correcting the Variation of, xxix 113

..... Apparatus for Correcting the Local Variation of, on board Ship, by Mr. P. Barlow, xxxix 76

..... *Ship's*, an Improved, by Lieut. R. P. Littlewort, xl 70

Congreve, Wm. Esq., on Planting Larches, xxix 34

..... on Planting Acorns, xxxiv 64

..... on Planting Oaks, xxvii 30

Conolly, J. Esq., on a Portable Telegraph, xxxvi 98

..... on a Telegraphic System and Dictionary, xxxv 205

Cook, Mr. B., on Varnish and Naphtha, from Coal-tar, xxviii 73

..... Mr. T., Lt. R. N., on a Night Life Buoy, xxxvi 121

..... on a Life Raft, xxxvii 110

Cooke, Mr. M., his Apparatus for teaching Music to the Blind, xxx 143

..... W. Esq., on the use of Salt in Anatomical Preparations, xxxvii 43

Copper Plates, Mr. Ramshaw's Method of heating by means of Steam, xxxvi 95

Cork Institution, thanks to, for Specimens of Irish Marbles, xxx 109

Corn. See *Grain*

Corn. Instrument for Cleaning, by Mr. C. Essex, xxxv 164

Corn-Mill, Family, by Mr. C. Williams, xxxii 102

..... the Portable French Military, xxxv 155

Corn-Mills, Method of Adjusting the Bed-stone of, by Mr. T. Austen, xxxviii 65

Corn-rick, Temporary, xxix 46

Corston, Mr. W., on the Manufactory of Straw Plat, xxviii 130

Cotton, Capt. Jos., on Caloe Hemp, xxxiii 182

Counting-machine, a, by Br. Donkin, Esq., xxxvii 116

Cowley and Staines, Messrs., on British Opium, xl 9

..... on Preserving Turnips through the Winter, xl 29

Cowlishaw, Mr. Henry, on Planting Larches, xxix 36

Cows. See *Cattle*

Crane, Self-adjusting, by Mr. James Jones, xxxv 141

..... a Self-adjusting, by Mr. A. Ainger, xxxvii 124

Crank for Telegraph. See *Telegraph*

Creyke, Ralph, Esq., on Planting Forest Trees, xxxvi 22—xxxvi 19

Cross for Horses. See *Horses*

Crutch for Pendulums. See *Clock*

Crutch, Mr. G. Prisley's Spring, xxviii 239

Crutches, for the Lame, by J. Lawrence, Esq., xxxii 109

Cubitt, Mr. W., on an Instrument for drawing Ellipses, xxxiv 131

Cumming, G., M.D., on a Vapour Bath, xxx 181

Digitized by Google

Curtis, Mr. Samuel, on Planting an Orchard of 50 Acres, xxvi 123

Curvagraph, a, by Mr. W. Warcup, xxxv 109

Curwen, J. C. Esq., M. P., on the Culture of Cabbages and Potatoes, xxvi 79

..... on Planting Larches, and other Forest Trees, xxvii 21

..... on Stall-feeding Cattle, xxviii 33

..... on feeding Milch-cows with Steamed Food, xxx 58

..... on Stall-feeding Cattle, xxxii 56

..... on Improving Waste Land, xxxiii 25

..... on Burning Clay and Sods, by means of Quick Lime, xxxiv 51

..... Experiment on Fattening Cattle, xxxiv 48

..... Experiment on Draining Land, xxxix 36

Cuthbert, Mr. J., on a Chemical Hydro-pneumatic Apparatus, xxxvii 105

Cutting Instruments, use of Soap in Setting, by G. Reveley, Esq., xxxix 137

Davies, Mr. G., on a Sun-Dial, xxxviii 147

Davis, Dr. D. M. D., on a Craniotomy Forceps, xxxv 188

..... Mr. John, on a Fire Escape, xxviii 175

..... Mr. Jos., on a Temporary Scaffold, xxx 168

..... his Stove for Burning Wood Shavings, xxxi 155

Dawson, Ed. Esq., on Embanking Land from the Sea, xxxix 33

Denovan, Mr. J. F., on British-cured White Herrings, xxxvii 188—xxxviii 186

Devonshire, The Duke of, on Planting Forest Trees, xxxviii 1

Diamond-mines, at Mallavelly in India, Description of, xxvii 247

Dibble for Acorns. See *Agricultural Instruments*

Dick, Mr. D., on an Instrument for Drawing in Perspective, xxxv 89

Dickson, Mr. Jone, on Propelling Steam-boats, xxxiv 240

Dividing-Engine, Mathematical, Mr. J. Allan's, xxviii 179

Domes, Scaffold for the Interior of, xxxi 208

Donkin, B. Esq., on an Instrument to ascertain the Velocity of Machinery, xxviii 185

..... on a Counting Machine, xxxvii 116

Door-fastening, a, by Mr. Jas. Horne, xxxiv 243

Door, Double, Spring for a, by Mr. James White, xxxviii 70

Door-hinge, Double, by Mr. S. Lake, xxxix 135

Door-lock. See *Lock-door*

Door-spring, Double, by Mr. J. Stone, xxxii 173

..... Double, by Mr. J. Barrow, xxxiii 146

..... by Mr. James White, xxxvii 102

Door-spring, Single, by Mr. J. Barrow, xxxiii 148

..... by Mr. Ed. Parker, xxxiv 230

..... by Mr. J. Henlon, xxxvi 71

Doors, method of Preventing from Dragging, by Mr. John Tad, xxvi 196

Douglas, Mr. N., on an Instrument for Firing Cannon, xxxi 211

D'Oyly, Mrs. H., on the Culture of Bull-rushes for Chair-makers, xxxv 44

Drag for Carriages. See *Wheel Carriage*

Digitized by Google

Drag, &c. for raising Drowned Bodies, xxvii 125

Draining Land, Experiment on, by J. C. Curwen, Esq. M. P., xxxix 36

Draw-boy. See *Weaving*

..... for Silk Weavers, by Mr. Richards, xl 181

Drawing. See *Painting*

Drawing-board, Mr. E. Turrell, on a, xxxiv 139

Drawings, Chalk, Mr. Cathery's Method of Fixing, xxx 111

Drowning, Instrument to Preserve Persons from, when the Ice breaks, by J. Miller, Esq., xxxii 194

Drowned Bodies, Drag for. See *Drag*

Drury, Mr. C., on a Strong Paste from Potatoes, xxxi 113

..... on an Instrument for feeding Horses while Travelling, xxxii 158

Dry-grinding. See *Grinding Dry*

Dry-grinders, Magnetic Guard for, by Mr. J. C. Abraham, xl 135

Dry Rot. See *Rot dry*

Durand, Mr., on a Machine for Dressing Hemp, xxxi. 268

Earle, Henry, Esq., on a Bedstead for Invalids, xxix 118

Earthen-walls. See *Walls*

Easel, Painter's. See *Painting*

Earthenware, Common Red, a Glaze for, by J. Meigh, Esq., xl 44

Edelcrantz, The Chevalier, A. N., on a Telegraph, xxvi 184

Einsle, Mr. S., on the Preparation of Ivory Paper, xxxvii 59

Elliott, Mr. O., on a Safe Coach, xxxviii 143

Ellipses, Instruments for Drawing. See *Painting and Drawing*

Embanking Land from the Sea, 175 Acres in Chelson Bay, Devon, by Lord Borringdon, xxvi 30

..... 100 Acres in the parish of Heybridge, Essex, by W. Lawrence, Esq., xxvi. 35

..... 110 Acres in the parish of Latchingdon, Essex, by Henry Coape, Esq., xxxiii 36

..... 300 Acres, on the Gnoll and Britton Ferry Marshes, Glamorganshire, by the Earl of Jersey and Henry Grant, Esq., xxxv 38

..... 564 Acres at Windermoot, Lancashire, by J. Stockdale, Esq. and R. Towers, Esq., xxviii 42

..... Aldcliffe Marsh, near Lancaster, by Ed. Dawson, Esq., xxxix 33

..... 400 Acres in the Co. of Tyrone, Ireland, by J. Austin, Esq., xxx 32

Enamel Colours, Receipts for, by Mr. R. Wynn, xxxv 49

Engraving, Aquatint, Improvements in, xxviii 97

..... on Steel, by Messrs Perkins and Co., xxxviii 47

..... in Mezzotinto on Soft Steel, by Mr. T. Lupton, xl 41

Engravers, Parallel Rule for. See *Painting, &c.*

Equation-work. See *Clock*

Errington, Geo. Esq., on Curing White Herrings, xxvi 231

Escapement. See *Clock*

Espinasse, Is. Esq., on the Management of Bees, xxxvi 29

Essex, Mr. C., on a Machine for Cleaning Corn, xxxv 164

Eye-bath, Mr. J. D. Ross's, xxvii 203

Farey, Mr. J. jun. on an Instrument for Drawing Ellipses, xxxi 117

..... on an Instrument for Drawing Lines to an inaccessible Centre, xxxii 71

..... Mr. Jos. on a Ball-cock, xxxv 175

Farnham, Mr. W., on a Steam-trap, xxxv 178

Digitized by Google

Fayrer, Mr. W., on a Three-wheeled Clock, xxxvii 138

Feetham, Mr. W., on an Apparatus for Sweeping Chimnies, xxxvii 128

Fibre, Vegetable, from Bean Stalks, xxvii 57

..... from Nettles, xxviii 109—xxix 81

Field, Mr. G., on a Filtering Apparatus, xxxiv 87

File, for Receipts, Mr. R. White's, xxvii 170

Filtering Apparatus, by Mr. G. Field, xxxiv 87

Filtering-stone, Mr. W. Moult's, xxviii 212

Finger-post, of Cast Iron, by Mr. Jas. Swaine, xxxi 240

Fir, Scotch, Turpentine from, xxviii 86

Fire-arms, Mr. Baker's Improvement in, xxviii 199

..... Regulating Screw for the Main-spring of, by Mr. Ez. Baker, xl 118

Fire-escape, Mr. Braby's, xxxiv 227

..... Mr. J. Davis's, xxviii 175

..... Mr. T. Roberts's, xxxi 195

..... Mr. A. Young's, xxxi 244

..... Mr. G. A. Witty's, xxxix 130

Fire-Engines, Improved Hose for, by Mr. Jae. Perkins, xxxviii 102

Fisher, Mr. T., on a Swivel-headed Churn Staff, xxvi 131

Flags, New System of Cutting, by Admiral Sir H. Popham, xxxiv 173

Flax and Hemp. See *Hemp*

Flute, German, by Mr. M. M'Gregor, xxxi 215

Folch, Mr. T., on Glass Tablets to Teach Children to Write, xxxii 162

Foot-rot in Sheep. See *Sheep*

Forceps, Craniotomy. See *Surgical Instruments*

Forcing-pump. See *Pump*

Forest-trees. See *Trees Forest*, and *Plantations*

Forgery, on the Prevention of, xxxiii 47

Fortune, Mr. F., on Curing White Herrings, xxix 158

Franklin, Mr R. W., on a Double-Piston Pump, xxxiii 115

Fruit, Mr. T. Lane's Instrument, for Gathering, xxxvii 20

..... Preserving without Sugar, by Mr. T. Saddington, xxvi 145

Fruit-trees, Plantations of. See *Plantations*

Fuller, Mr. John, on an Improved Scarificator, xxix 126

Fulton, Mr. H., on a Protractor, xxxiii 84

Furze, Advantage of, for Feeding Horses, xxvii 77

Gall. See *Ox-Gall*

Gas-lamp. See *Lamp*

Gas-meter, by Mr. J. Malam, xxxvii 167

German Flute. See *Flute*

Gilders, Head-piece for, xxix 138

Gilpin, Mr. Gilbert, Supplement to the Description of his Machine for Raising Coals, in Vol. xxv., xxvi 194—xxvii 206

Glass, Enamel Colours for, and the Art of Staining Glass, by Mr. R. Wynn, xxxv 49

Glaze for Porcelain. See *Porcelain*

Gold Medal. See *Medal*

Goodwin, Mr. C., on a Bridle-bit, xl 66

..... Jos. Esq., on a Spring Cross for Horses, xxxix 119

..... on a Probang for Horses, xxxiv 235

Gordon, Capt. H., on a Life-boat, xl 73

Gorman, J. Esq., on a Spring Bandage,

Digitized by Google

for Cases of Abdominal Weakness, xxxviii 76

Goss, Mr. J., on an Instrument to Perform Addition of Numbers, xxx 159

Grain, Mr. W. Bowler, on an Apparatus for Drying, xxxiii 47

Granite, Scotch, Specimens of, xxviii 71

Grant, Henry, Esq., on Embanking Land from the Sea, xxxv 38

..... T. Esq., on a Life Preserver in case of Shipwreck, xxxvi 62

Grece, Mr., on the Culture of Hemp in Canada, xxvii 220

Green, Mr. Rd., on Instruments for Scooping out the Eyes of Potatoes, xxxi 74

..... Mr. R., on a Plough-gage for Cutting Leather, xxxvii 89

Grinding Dry, Contrivance to prevent Injury to Persons employed in, by Mr. T. Wood, xxix 143

..... Mr. G. Prior, jun. xxxi 206

..... Mr. T. Roberts, xxxiv 233

..... Mr. J. C. Abraham, xl 135

Gun-carriage, of Wrought-Iron, by Mr. R. Pering, xl 54

Gun-lock, Percussion, by Mr. C. Hall, xxxvi 80

Gunpowder-mills, Contrivance to diminish the risk of Explosion in, by Mr. James Monk, xxxvii 161

Haggitt, Fr., the Rev. Dr., on Improving Waste Land, xxx 37

Halkin-mountain, Flintshire, Discovery of a Quarry of Millstone in, xxxix 55

Hall, Mr. C. on a Percussion Gun-lock, xxxvi 80

..... The Rev. James, on Fibre from Bean Stalks, xxvii 57

..... J. C. Esq., on Protecting Merino Sheep, xxxiv 78

..... Mr. Wm., on an Angulometer, xxxv 114

Halk, Mr. T., on a Self-acting Apparatus to supply Steam-Engine Boilers with water, xl 127

Hand, a Ruler and a Pen-holder for persons who have lost a, by Mr. T. Lane, xxxvi 74

Hands, Implements for the use of persons who have lost their, by Mr. Morrison, xxviii 241

Hand-rail, Method of Squaring, by Mr P. Nicholson, xxxii 121

Hardy, Mr. W., on an Inverted Spring Pendulum, xxxvii 147

..... on a Detached Clock Escapement, xxxviii 165

Harp-guitar, by Mr. M. Levien, xxxii 117

Harrow, expanding, Mr. W. Jeffrey's, xxviii 51

Harrison, Mr. Ar., on a Parallel Rule for the use of Engravers, xxxviii 45

Hassells, Mr. J., on Improvements in Aquatint Engraving, xxviii 97

Hat-making, use of Buffalo Wool in, by Mr. W. Pritchard, xl 228

Hats, Straw, Machine for Blocking, by Mr. T. Scorrar, xxxiii 90

..... an Improved Machine for Blocking, by Mr. T. Scorrar, xxxiv 163

..... tips for, a Machine for Cutting, by Mr. B. Rider, xxxix 70

Hay-borer, a, by Mr. Ar. Biddle, xl 36

Hay, Machine for Binding and Weighing Trusses of, by Mr. C. Beckway, xxxvii 15

Hedderwick, Mr. P., on a Double-Piston Pump, xxxii 98

Hemman, Mr. S., on a Cast Iron Mooring Block, xxviii 170

Hemp, Caloe. See *Caloe Hemp*

Hemp, Mr. Murray's Machine for Hackling, xxvii 148

Digitized by Google

Hemp, Mr. Durand's Machine for Dressing, xxxi 268

..... Cultivation of, in Canada, xxvii 220

Hemp, Cultivation of, in Somersetshire, and Dorsetshire, xxix 63

Henlon, Mr. J., on a Single Door-Spring, xxxvi 71

Herrings, White, British cured, by Mr. J. F. Denovan, xxxvii 183, xxxviii 186

..... Method of Curing, by Mr. Errington, xxvi 231

..... Method of Curing, by Mr. Fortune, xxix 158

..... Method of Curing, by Mr. P. Slevins, xxix 161

..... by Mr. J. Lewis, xxxi 253

..... by Mr. T. Styles, xxxi 258

Heselden, Bryan, Major, on Improving Waste Land, xxx 40

..... on Reclaiming Waste Land, xxxi 25

Heyne, Dr. B., on the native Soda of India, xxvii 238

..... on the Diamond Mines at Mallavilly, xxvii 247

Hibbert, Sam. M. D., on the Discovery of Chromate of Iron in Shetland, xxxviii 23

Higgins, Godfrey, Esq., on Improving 180 Acres of Waste Land, xxxii 27

Hobbles for Horses. See *Horses*

Hoblyn, T. Esq., on Importing Cocoa-nut Oil, xxxiii 60

..... on a Press for Cocoa-nut Oil, xxxiv 261

Hodge, Mr. Ar., on a Pot, for Preserving Butter from Rancidity, xxx 87

Hodgson, Mr. J., on Correcting the Variation of the Compass, xxix 113

Holditch, Mr. G., on a Life-Beacon, xl 61

Holdsworth, Ar. Esq., on the Timbering of Roofs, xxxviii 62

Homograph. See *Telegraph*

Hood, Mr. S., Specimens of Canvass, for the Use of the Navy, xxxiv 165

Hookey, Mr. W., on a Method of bending Ship-timber, xxxii 91

..... on Improved Rudders, &c. xxxviii 125

..... on a Coffer to repair Ships Afloat, xl 122

Horn, Mr. W., on a Machine for Cutting Canvass for Sails, xxxii 152

Horne, Mr. James, on a Door-fastening, xxxiv 243

Horse fallen in the Shafts, Method of Relieving, by Mr. Martin, xxx 170

..... by Mr B. Smith, xxviii 215

..... by Mr. Aust, xxxv 158

Horses, Hobbles for, by Mr. B. Clark, xxxiii 140

..... Instrument for Feeding them while Travelling, by Mr. C. Drury, xxxii 158

..... Probang for giving Medicine to by Jos. Goodwin, Esq., xxxiv 235

..... a Spring Cross for, by Jos. Goodwin, Esq., xxxix 110

Hose, for Fire Engines. See *Fire Engines*

Hoven-cattle. See *Cattle*

Hubbard, Mr. J. P., on the Marble of Babicomb, in Devonshire, xxvii 85

Hughes, Mr. G., on a Temporary Scaffold for the interior of Domes, xxxi 203

..... Mr. R., on an Improved Axle for Water-wheels, xxxi 221

..... Mr. J., on an Improvement in the Silk-weaver's Drawboy, xl 181

Hullmandell, Mr. C., on Lithography, xxxvii 53

Hutton, Mr. Jos. jun., on a Reaping Hook, xxviii 54

Hydrometer, for Spirits, by Mr. H. Stokes, xxxviii 27

..... a Correctional Scale for Temperature, by Mr. A. Ainger, xl 100

Digitized by Google

Hyslop, J. Esq., on a Lancet for Opening deep-seated Abscesses, xxxiii 112

Indigo, East Indian, Dr. Roxburgh, on, xxviii 251

Instruments, Surgical. See *Surgical*

Ivory paper. See *Paper*

Jamieson, Mr. R., on a Marine Thermometer Case, xxxviii 32

Jeffrey, Mr. W., on an Expanding Harrow, xxviii 51

Jeffries and Halley, Messrs., on a Blowing Machine for Smiths and Founders, xxxviii 87

Jennings, Mr. H. C., on a Mercurial Log-glass, xxxviii 115

Jersey, the Earl of, on Embanking Land from the Sea, xxxv 38

Johnes, Thos. Esq. M. P. on Planting Larch-trees, xxviii 30

Jones, Mr. Edwin, on a Machine for serving Ship's Ropes, xxxiii 87

..... Mr. James, on a Self-adjusting Crane, xxxv 141

..... on Improved Pulley-blocks, xxxvi 103

..... J. M. Esq., on Planting Larch and other Timber-trees, xxxi 36

..... W. Esq., on a Temporary Corn Rick, xxix 46

Jopling, Mr. J., on Working a Quarry of British Marble, xxviii 59

..... Mr. Jos., on constructing the Ribs of Groined Arches, xxxviii 86

Jury-masts. See *Ship-building, &c.*

Keyworth, Mr. T., on Horn Tablets to teach Children to write, xxxii 167

King, Mr. J., on a Machine for the use of Boot and Shoe-makers, xxx 173

..... Mr. R., on an Improved Mode of Constructing Anvils, xxxviii 78

Knight, Mr. Ed., on sowing Wheat after Beans, without an intermediate Fallow, xxxi 76

..... Premium for Twenty-one Stocks of Bees, xxxi 79

Knowlys, W. C. Esq., on Reclaiming Waste Land, xxxi 33

Lake, Mr. S., on a Double Door-hinge, xxxix 195

Lamp, Gas, a, by Mr. W. Caslon, xxxv 162

Land, Gaining from the Sea. See *Embanking*

..... Waste. See *Waste Land*

Lane, Mr. T., on a Ruler and Penholder for Persons who have lost a Hand, xxxvi 74

..... on a Turning Lathe, xxxvi 109

..... on an Instrument for Gathering Fruit, xxxvii 20

Larch, Use of the Bark in Tanning, xxxi 81

Latch Spring. See *Lock*

Lathe, Turning, Improvements on the, by Mr. T. Lane, xxxvi 109

Laurence, J. Esq., on Improved Crutches for the Lame, xxxii 109

Law, Mr. A., on a Telegraph, xxxiii 118

..... on a Method of securing Ship's Guns, xxxiii 122

Lawson, J. Esq., on Planting Forest Trees, xxxv 35

Lawrence, Wm. Esq., on Gaining Land from the Sea, xxvi 35

Leather. See *Tanning*

Leather Straps, Machine for Cutting, by Mr. Aubery, xxviii 192

..... by Mr. R. Green, xxxvii 89

Lee, H. B., Esq., on a Thrashing Machine, xxviii 25

Leeches, Mechanical Substitute for, by Mr. J. Whitford, xxxi 229

Leghorn-Plat. See *Plat*

Le Hardy, Major Charles, on a Telegraph, xxvi 180

Digitized by Google

Le Hardy, Major Charles, on the Culture and Use of Parsnips in the Island of Jersey, xxvii 52

..... Method of effecting a Communication between a Stranded Ship and the Shore, xxxiv 182

Lester, Mr. William, on a Machine for Washing Potatoes, xxvii 34

Levien, Mr. M., on a Harp Guitar, xxxii 117

Lewis, Mr. J., on British-cured White Herrings, xxxi 253

Liddell, W., Esq., on Planting Oaks, xxxii 25.

Life Beacon, a, erected by Mr. G. Holditch, xl 61

Life Boat. See *Shipwreck*

Life Buoy, Night, Mr. Cook's, xxxvi 121

Life Raft. See *Shipwreck*

Lithographic Portable Press, by Mr. R. Ackermann, xxxvii 131

Lithographic Stone, Quarry of, near Stratford on Avon, xxxvii 58

Lithography, Method of Executing, by Mr. C. Hullmandel, xxxvii 53

Littlewort, R. P., Lieut., on a Ship's Compass, xl 70

Llandaff, The Bishop of, on Planting Larches, xxvi 27

Lock, Mr. Bramah's, description of, xxxviii 205

..... Mr. Al. Ainger's Spring Latch, xxxviii 111

Lock, Door, by Mr. M. Somerford, xxxvi 111

Lock for Liquor Cocks, by Mr. W. Russell, xxxvii 94

Log-glass, Mercurial, by Mr. H. C. Jennings, xxxviii 115

Loom. See *Weaving*

Loom for Ribbon Weavers. See *Ribbon Weavers*

Loom for Silk Weavers. See *Silk Weavers*

London, Mr. Phillips, on Pickling Mackarel, xxxi 263, xxxiii 153

Lupton, Mr. T., on Engraving in Mezzotinto on Soft Steel, xl 41

Machell, Mr. T., on an Annular Saw, xxx 150

..... Mr. J., on Plantations of Forest Trees, by the Duke of Devonshire, xxxviii 1

Machines. See *Plates*

Mackarel, Method of Pickling, by Mr. P. London, xxxi 263, xxxiii 153

Maclachlan, Mr. J., on Fossil Salt from India, xxvii 229

Madder, Smyrna, raised from Seeds by Mr. W. Salisbury, xxvii 104

Magnetic Hammer, Mr. J. D. Ross's, xxviii 206

Mahogany, Method of Seasoning, by Mr. James Callender, xxxv 71

Malam, Mr. J., on a Gas-meter, xxxvii 167

Man-trap, Mr. R. Salmon's, xxvii 181

Manby, G. W., Captain R.N., on an Apparatus for Preserving the Lives of Shipwrecked persons, xxvi 209

Mangel Wurzel, Culture and Use of, by Mr. L. Phillipps, Jun., xxxii 48

Mansfield, the Earl of, on Planting Oaks, xxvi 25

Manure, the Rev. Dr. Cartwright on the use of Burnt Clay, as a, xxxvi 9

Maudsley, Mr. H., his Mill for Decorticating Rice, xxxiv 252

Map of Canada, by Lieut. Colonel Bouchette, xxxiv 245

Map, Mineralogical, of England and Wales, by Mr. W. Smith, xxxiii 51

Map of Shropshire, by Mr. R. Baugh, xxvii 109

Digitized by Google

MED

Marble from Babicomb in Devonshire, xxvii 85

Marble, British, Specimens from Ireland, xxviii 68

Marble, Quarries of, at Assynt in Sutherland, N. B., xxviii 59

Marbles from the Co. of Cork, List of, xxx 109

Marshall, Mr. G., on a Swing Window Sash, xxviii 209

..... Mr. St., on Blocks for Calico Printers, xxxii 85, xl 178

Martin, Mr. Jos., on a Method of Relieving a Fallen Horse from the Shafts, xxx 170

..... Mr. W., on an Index Weighing Machine, xxxii 157

Mason, Mr. W. W., on Curing Hoven Cattle, xxvi 128

Matting, &c., made of the Leaves of *Typha Latifolia* by Mr. W. Salisbury, xxxix 52

Medal, Gold, Large, to

H. Ainslie, M.D., for Planting 151,240 Forest Trees, xxx 25

Mr. J. Allan, for an Improved Mathematical Dividing Engine, xxviii 179

Henry Andrews, Esq., for Planting Oaks, xxix 30

The Chevalier P. Assalini, for Improved Surgical Instruments, xxxiii 93

J. Austin, Esq., for Embanking nearly 400 Acres from the Sea, xxx 92

Mr. J. H. Abraham, for a Magnetic Guard for Dry Grinders, xl 135

Backhouse, E., Esq., for Planting 363,000 Larches, xxxii 32

..... W., Esq., for Planting 300,000 Larches, xxxi 67

A. Bain, M.D., for Planting Forest Trees, xxvi 41

..... for Planting 258,000 Firs, xxix 25

MED

Medal, Gold, Large, to

Mr. J. Baker, for an Instrument for Eradicating Docks and Thistles, xxviii 50. (This entry in the Volume is erroneous; for Gold read Silver)

And a Set of the Society's Transactions, to Mr. P. Barlow, for his Apparatus for Correcting the Local Variation of a Ship's Compass, xxxix 76

Captain W. Bolton, R. N., for his Method of Setting up the Shrouds and Lower Rigging of Ships, xxvii 139

Lord Boringdon, for Embanking Land from the Sea, xxvi 30

Lieut. Colonel Bouchette, for a Map of Canada, xxxiv 245

Ambrose Bowden, Esq., for a Method of Preventing Dry Rot in Ship Timber, xxxvi 53

R. H. Bradshaw, Esq., M.P., for Reclaiming Peat Moss, xxxvi 1

George Bucke, Esq., for Pure Merino Wool grown in England, xxxiv 155

Robert Burrows, Esq., for Experiments on the Culture of Wheat, xxvi 93

The Rev. Edm. Cartwright, D.D., for Experiments on the efficacy of Burnt Clay as a Manure, xxxvi 9

Messrs Cowley and Staines, for Preserving Turnips through the Winter, xl 29

Messrs. R. and G. Cayme, for Canvass equal to the best Dutch, xxx 139

W. R. Clanny, M.D., for a Safe Lamp for Colliers, xxxv 75

Mr. Jos. Clement, for an Instrument for describing Ellipses, xxxvi 133

Henry Coape, Esq., for Embanking Land from the Sea, xxxiii 36

William Congreve, Esq., for Planting 74 Acres of Oaks, xxvii 30

..... for Planting 684,000 Larches, xxix 34

..... for Planting Acorns, xxxiv 64

Mr. T. Cook, Lieut., R. N., for a Life Raft, xxxvii 110

Mr. M. Cooke, for an Apparatus for Teaching Music to the Blind, xxx 143

Digitized by Google

Medal, Gold, Large, to

J. C. Curwen, Esq., M.P., for Improvements in the Culture of Cabbages and Potatoes, xxvi 79

..... for Planting Larches and other Forest Trees, xxvii 21

..... for Experiments on Stall Feeding Cattle, xxviii 33

..... for Improving Waste Land, xxxiii 25

..... for an Experiment on Feeding Cattle, xxxiv 48

David D. Davis, M. D., for a Craniotomy Forceps, xxxv 188

Ed. Dawson, Esq., for Embanking Land from the Sea, xxxix 33

The Duke of Devonshire for Planting Forest Trees, xxxviii 1

B. Donkin, Esq., for an Instrument to ascertain the Velocity of Machinery, xxviii 185

Henry Earle, Esq., for a Bed for Surgical Patients, xxxix 113

Elliott, Mr. O., for a Safe Coach, xxxviii 143

Mr. J. Farey, Jun., for an Instrument for Drawing Ellipses, xxxi 117

Mr. Francis Fortune, for Curing White Herrings in the Dutch Method, xxix 158

T. Grant, Esq., for a Life-preserver in case of Shipwreck, xxxvi 63

The Rev. Fr. Haggitt, D.D., for reclaiming 50 Acres of Boggy Land, xxx 37

J. G. Hall, Esq., for Protecting 1,160 Merino Sheep, xxxiv 78

And Fifty Guineas, to Mr. W. Hardy, for a Detached Clock Escapement, xxxviii 165

Major Le Hardy for a mode of effecting a Communication between a Stranded Ship and the Shore, xxxiv 182

Major Bryan Heselden for reclaiming 177 Acres of Waste Land, xxxi 25

Godfrey Higgins, Esq., for Improving 180 Acres of Waste Land, xxxii 27

Medal, Gold, Large, to

Mr. W. Hookey, for his Method of Bending Ship Timber, xxxii 91

..... for Improved Rudders, &c., xxxviii 125

Mr. J. P. Hubbard, for Specimens of Marble from Babicomb, near Teignmouth, xxvii 85

Thomas Johnes, Esq., M.P., for Planting Larch Trees, xxviii 30

Mr. Isaac Jopling, for Working Quarries of Marble at Assynt in Sutherland, N. B., xxviii 59

Mr. Ed. Knight, for Sowing Wheat after Beans, without an intermediate Fallow, xxxi 76

J. Lawson, Esq., for Planting Forest Trees, xxxv 35

H. B. Lee, Esq., for a Thrashing Machine, xxviii 25

Mr. J. Lewis, for British-cured White Herrings, xxxi 253

William Liddell, Esq., for Planting 8,000 Oaks, xxxii 25

The Bishop of Llandaff, for Planting Larches, xxvi 27

J. Mac Arthur, Esq., for Fine Wool equal to the Saxon, the Produce of his Flocks in New South Wales, xl 230

..... for Importing *15,130 lbs.* of Fine Wool, the Produce of his Flocks in New South Wales, xl 230

Mr. T. Machell, for an Annular Saw, xxx 150

G. W. Manby, Captain R. N., for an Apparatus for Preserving the Lives of Shipwrecked Persons, xxvi 209

The Earl of Mansfield, for Planting Oaks, xxvi 25

Michael Meek, Esq., for Planting Forest Trees, xxxiv 67

Meigh, J., Esq., for a Glaze for Common Red Earthenware, xl 44

John Miller, Esq., for a Drag for Raising Drowned Bodies, xxvii 125

Matthew Murray, Esq., for a Machine for Hackling Hemp or Flax, xxvii 148

Digitized by Google

Medal, Large Gold, to

C. F. Palmer, Esq., M.P., for Planting Oaks, xxxix 1

..... for Planting Forest Trees, xxxix 6

Mr. J. Park, for a Mooring Block, xxxvi 84

J. Peart, Esq., for reclaiming Waste Land, xl 1

Captain J. Peat, for a Temporary Rudder, xxxi 161

Mr. Jac. Perkins, for a Ship's Pump, xxxviii 106

Admiral Sir Home Popham, for a Telegraph and Marine Vocabulary, xxxiv 167

Jos. Ridgway, Esq., for reclaiming Waste Land, xxxviii 15

Mr. W. Rodger, Lt., R. N., for a Life Raft, xxxvii 112

The Duchess of Rutland, for Comparative Experiments on the best mode of Raising Oaks, xxxiv 53

And One Hundred Guineas, to Mr. Jas., Ryan for his System of Ventilating Collieries, xxxiv 94

Ed. Sheppard, Esq., for 7,749 *lbs.* of Fine Wool, the produce of his Merino Flocks, xxx 130

J. Stockdale, Esq., and R. Towers, Esq., for Embanking 564 Acres of Land from the Sea, xxviii 42

Wm. M. Thackeray, M.D.. for Plantations of Forest Trees, xxvii 25

..... for Planting Forest Trees, xxxvii 1

B. Thornhill, Esq., for Planting Forest Trees, xxxiii 33

Mr. Charles Waistell, for his Method of ascertaining the Progressive Value of Growing Timber Trees, xxvi 45

George Whitworth, Esq., for Manufacturing Ropes and Sacking of Wool, xxvi 153

Mr. Andrew Wilson, for Stereotype Printing, xxviii 317

Sir W. W. Wynne, Bart., M.P., for Planting Forest Trees, xxxvi 18

Medal, Small Gold, to

Mr. A. Ainger, for his Scale for Correction of Temperature as applied to the Hydrometer, xl 160

Mr. Jas. Allan, for a Theodolite, xxxiv 206

Mr. J. Barraud, for a Violoncello, xxxvii 67

Messrs. Bishop & Co., for the Discovery and Working of a Quarry of Fine Mill-stones, xxxix 55

Mr. W. Behnes, for an Instrument for Transferring the Points in Sculpture, xxxvii 172

Mr. W. Bremner, for an Instrument for the extirpation of Polypi, xxxiv 184

Capt. Jas. Burton, R. N., for a method of propelling Ships of War, xxxviii 186

Mr. C. A. Busby, for a Hydraulic Orrery, xl 98

The Rev. Dr. Cartwright, for a Traversing Apparatus, xxxiv 177

Mr. Conolly, for a Telegraphic System and Dictionary, xxxv 205

Mr. T. Cook, R. N., for a Night Life Buoy, xxxvi 121

J. C. Curwen, Esq. M. P., for Feeding Milch Cows with Steamed Food, xxx 18

Br. Donkin, Esq. for a Counting Machine, xxxvii 116

Mr. C. Essex, for a Machine for Cleaning Corn, xxxv 164

Mr. G. Field, for a Filtering Apparatus. xxxiv 87

Mr. T. Folch, for Glass Tablets to teach Children to Write, xxxii 162

Mr. W. Hardy, for his Inverted Spring Pendulum, xxxvii 147

S. Hibbert, M. D., for the Discovery of Chromate of Iron in Shetland, xxxviii 23

T. Hoblyn, Esq., for introducing into Ceylon, a Machine for decorticating Rice, xxxiv 250

Mr. Jas. Jones, for a Self-adjusting Crane, xxxv 141

Digitized by Google

Medal, Small Gold, to

J. M. Jones, Esq., for Planting 50 Acres of Land with Larch and other Timber Trees, xxxi 36

Mr. Jas. Jopling, for his Method of Constructing the ribs of Groined Arches, xxxviii 83

W. C. Knollys, Esq., for Improving 308 Acres of Waste Land, xxxi 33

Mr. T. Lupton, for his Method of Engraving in Mezzotinto on Soft Steel, xl 41

Mr. J. Malam, for a Gas-meter, xxxvii 167

Mr. P. Nicholson, for a Method of Squaring a Hand Rail, xxxii 121

Mr. T. Pering, for an Instrument for Working Problems in Navigation, xxxiv 200

Mr. Jac. Perkins, for his Method of Drawing off the Back-water from Water Wheels, xxxviii 109

..... for an Orthometer and Pleometer, Instruments to Ascertain the Trim of Ships, xxxix 126

Mr. L. Phillipps, jun., for Planting 5000 Fruit-Trees, xxxi 64

..... for the Culture and Use of Mangel-Wurzel, xxxii 48

Sir W. Templer Pole, Bart., for Planting Oaks, xxxix 3

Mr. Jas. Ramshaw, for a Method of Heating Copper plates by Steam, xxxvi 95

And Thirty Guineas, to Mr. D. Ritchie, for an Improved Method of giving Motion to a Pendulum, xxxvi 114

Mr. J. Rose, for a Glaze for Porcelain, xxxviii 42

Mr. G. Scott, for a Clasp for Securing the Standing Rigging of Ships when broken, xxxii 192

T. H. Scott, Esq. for Improving 220 Acres of Waste Land, xxxii 34

Mr. M. Shuldham, Lt. R. N., for a Pulley-Block, xxxiv 189

Capt. G. F. Stack, for an Apparatus for the Use of those who have lost an Arm, xxxviii 121

Medal, Small Gold, to

Mr. T. Starkey, for Broad-cloth Manufactured of Fine Wool from New South Wales, xl 227

Patrick Steuart, Esq., for Planting 843000 Trees, chiefly Larch and Scotch Fir, xxxi 43

And Fifty Guineas, to Mr. J. Thompson, for an Improved Ribbon Loom, xl 195

Mr. Peltro W. Tomkins, for rendering Ox-gall colourless, xxxi 130

John Whatley, Esq., for a Machine for Grinding Potatoes, xxxi 46

T. White, Esq., for Tanning Leather by Larch Bark, xxxi 81

And Twenty Guineas, to Mr. W. Wynn, for a Time Keeper and Compensation Pendulum, xxxv 127

J. Young, Esq., for the Preparation of Opium in Great Britain, xxxvii 23

Medal, Large Silver, to

Mr. A. Ainger, for a Self-adjusting Crane, xxxvii 124

And Twenty Guineas, to Mr. Jas. Allan, for a Reflecting Circle, xxix 106

..... for his Engine for cutting the divisions on Circular Arcs, xxxix 142

Mr. T. Allason, for a Reticulated Square for Drawing, xxxiv 145

Mr. Wm. Anderson, for an Improved Method of Painting on Canvass in Oil Colours, xxvi 135

And Fifteen Guineas, to Mr. W. Aust, for a Lever for raising the Shafts off a fallen Horse, xxxv 158

Mr. T. Austen, for his Method of Adjusting the Bed-stone of Corn Mills, xxxviii 65

The Cheval. Baader, for a Method of Communicating Rotatory Motion, xxxiv 193

Jon. Backhouse, jun. Esq., for Planting 271000 Larches, xxxi 70

Digitized by Google

Medal, Large Silver, to

Capt. T. M. Bagnold, for a Method of Elevating or Depressing Ships' Guns, xxix 91

Mr. Ez. Baker, for Improvements in Fire Arms. xxviii 199

Capt. H. L. Ball, R. N., for Improved Anchors, and an Improved mode of Fishing Anchors, xxvi 170

Mr. T. Balls, for a Screw Adjusting Plough, xxviii 45

Mr. R. W. Barchard, for a Cylindrical Traversing Rake, xxxv 152

And Ten Guineas, to Mr. S. Barrallet, for a Shop-board for Tailors, xxxi 147

And Ten Guineas, to Mr. J. Barrow, for a Double Door Spring, xxxiii 146

And Fifteen Guineas, to Mr. R. Baugh, for his Map of Shropshire, xxvii 109

And Ten Guineas, to Mr. A. Bell, for an Universal Chuck for Turners, xxxvii 85

Mr. Ar. Biddle, for a Hay-borer, xl 36

Capt. Wm. Bolton, R. N., for Improved Jury Masts, xxvi 167

And Ten Guineas, to Mr. T. Boyce, for a Life-boat, xxxii 177

W. Brabazon, Esq., for a Rowlock, xxxvii 83

Mr. J. Braby, for a Weighing Machine, xxxiii 150

..... for a Fire-Escape, xxxiv 227

Mr. Gab. Bray, for a Life-Boat, xxxv 172

The Rev. Jas. Bremner, for a Method of Converting a Ship's-Boat into a Life-Boat, xxviii 135

And Fifteen Guineas, to the Rev. Jas. Bremner, for a Night Telegraph, xxxiv 213

And Ten Guineas, to the Rev. Jas. Bremner, for a Day Telegraph, xxxiv 222

Mr. W. Brunton, for a Pump for Well Sinkers, xxix 98

Medal, Large Silver, to

And Ten Guineas, to Mr. J. Buck, for an Instrument to Examine the state of Ships Bottoms at Sea, xxxiii 124

J. Butler, Esq, for Improving Waste Land, xxvi 117

Mr. L. Byron, for a Sinical Octant, xxxii 111

Mr. W. Caslon, for a Gas Lamp, xxxv 162

Mr. F. C. Cherry, for Improved Blocks and Springs for Wheel-Carriages, xxxviii 93

R. Clanny, M. D., for a Safe Lamp for Collieries, xxxiv 121

Mr. Bracey Clark, for Hobbles for Horses, xxxiii 140

Mr. T. Cleghorn, for a Buoyant Line, xxxii 181

Mr. B. Cook, for Varnish and Naphtha from Coal Tar, xxviii 73

W. Cooke, Esq., for the Use of Salt in Anatomical Preparations, xxxvii 43

And Ten Guineas, to Mr. J. Common, for a Double Drill Turnip Sower, xxxvi 24

J. Connolly, Esq., for a Portable Telegraph, xxxvi 98

Capt. Jos. Cotton, for Importing Caloe Hemp from India, xxxiii 182

Mr. Hy. Cowlishaw, for Planting Larches, xxix 36

Ralph Creyke, Esq., for Planting Forest Trees, xxxvi 22, xxxvii 9

Mr. W. Cubitt, for an Instrument for Drawing Ellipses, xxxiv 131

Geo. Cumming, M. D., for a Vapour Bath, xxx 181

Mr. Samuel Curtis, for Planting an Orchard of 50 Acres, xxvi 123

Mr. J. Cuthbert, for a Chemical Hydro-Pneumatic Apparatus, xxxvii 105

Mr. G. Davies, for a Sun-Dial, xxxviii 147

Mr. Jos. Davies, for a Temporary Scaffold, xxx 168

Digitized by Google

Medal, Large Silver, to

Mr. Jos. Davies, for a Stove for Burning Wood Shavings, xxxi 155

And Ten Guineas, to Mr. D. Dick, for an Instrument for Drawing in Perspective, xxxv 89

Mr. Jon. Dickson, for a Method of Propelling Steam Boats, xxxiv 240

Mr. N. Douglas, for an Instrument for Firing Cannon, xxxi 211

Mrs. H. D' Oyly, for the Culture of Bullrushes for Chairmakers, xxxv 44

Mr. Durand, for a Machine for Dressing Hemp, xxxi 268

Henry Earle, Esq., for a Bedstead for Invalids, xxix 118

The Chevalier A. N. Edelcrantz, for a Telegraph, xxvi 184

George Errington, Esq., for Curing White Herrings, xxvi 231

Mr. J. Farey, jun., for an Instrument for Drawing lines to an Inaccessible Center, xxxii 71

Mr. W. Feetham, for an Apparatus for Sweeping Chimnies, xxxvii 128

In a Gold Border, to the Flag Association, for a Specimen of Double Brocade Weaving, xxvii 113

And Fifteen Guineas, to Mr. R. W. Franklin, for a Double Piston Pump, xxxiii 115

Mr. Jno. Fuller, for an Improved Scarificator, xxix 126

Mr. H. Fulton, for a Protractor, xxxiii 84

Jos. Goodwin, Esq., for a Probang for Administering Medicine to Horses, xxxiv 235

Mr. C. Goodwin, for a Bridle-bit, xl 66

J. Gorman, Esq., for a Spring Bandage, in cases of Abdominal Weakness, xxxviii 76

And Fifteen Guineas, to Mr. J. Goss, for an Instrument to perform Addition of Numbers, xxx 159

With a Gold Rim, to Mr. Grece, for the culture of Hemp in Canada, xxvii 220

Medal, Large Silver, to

And Twenty Guineas, to Mr. M. M'Gregor, for a German Flute, xxxi 215

Mr. Collinson Hall, for a Percussion Gun Lock, xxxvi 80

The Rev. Jas. Hall, for preparing from Bean Stalks, a substitute for Hemp, xxvii 57

And Ten Guineas, to Mr. W. Hall, for an Angulometer, xxxv 114

And Thirty Guineas, to Mr. J. Hassell, for Improvements in Aquatint Engraving, xxviii 97

And Twenty Guineas, to Mr. P. Hedderwick, for a Double Piston Pump, xxxii 98

Mr. Samuel Hemman, for a Cast Iron Mooring Block, xxviii 170

T. Hoblyn, Esq., for Importing Coçoa Nut Oil from the Island of Ceylon, xxxiii 60

Mr. Jno. Hodgson, for a Method of Correcting the Variation of the Compass, xxix 113

And Ten Guineas, to Mr. Geo. Holditch, for a Life-beacon, xl 61

Ar. Holdsworth, Esq., for his Method of Constructing Roofs, xxxviii 62

Mr. W. Hookey, for a Coffer to Repair Ships Afloat, xl 122

Mr. W. Horn, for a Machine for cutting Canvass for Sails, xxxii 152

Mr. R. Hughes, for an Improved Axle for Water-wheels, xxxi 221

Mr. G. Hughes, for a Temporary Scaffold for the Interior of Domes, xxxi 203

Mr. C. Hullmandel, for Specimens of Lithography, xxxvii 53

Mr. Jos. Hutton, jun., for a Reaping Hook, xxviii 54

J. Hyslop, Esq., for a Lancet for opening deep-seated Abscesses, xxxiii 112

Mr. R. Jamieson, for a Marine Thermometer Case, xxxviii 32

Mr. W. Jeffery, for an Expanding Harrow, xxviii 51

Digitized by Google

Medal, Large Silver, to

And Fifty Guineas, to Messrs. Jeffries and Halley, for a Blowing Machine for Smiths and Founders, xxxviii 87

Mr. H. C. Jennings, for a Mercurial Log-glass, xxxviii 115

Mr. Jas. Jones, for Improved Pulley-blocks, xxxvi 103

Wm. Jones, Esq., for a temporary Corn Rick, xxix 46

Mr. T. Lane, for a Ruler and Quill Holder, for Persons who have lost a Hand, xxxvi 74

..... for a Turning Lathe, xxxvi 109

Mr. A. Law, for his Method of securing Ships Guns, xxxiii 122

Wm. Lawrence, Esq., for Gaining Land from the Sea, xxvi 35

Chas. Le Hardy, Esq., for an Account of the Culture and Use of Parsnips in the Island of Jersey, xxvii 52

..... for a Telegraph, xxvi 180

Mr. Wm. Lester, for a Machine for Washing Potatoes, xxvii 34

Mr. Phillips London, for Pickling Mackarel, xxxi 263

With a Gold Border, to Phillips London, Esq., for Curing Mackarel, xxxiii 153

R. P. Littlewort, Lieut. R. N., for a Ship's Compass, xl 70

Mr. W. W. Mason, for Curing Hoven Cattle, xxvi 128

Mr. J. Millikin, for an Improved Bistoury, xl 69

And Twenty Guineas, to Mr. Jas. Monk, for Diminishing the risk of explosion in Gunpowder Mills, xxxvii 161

And Forty Guineas, to Mr. J. Morrison, for Implements for the Use of Persons who have Lost their Hands, xxviii 241

Mr. Wm. Moult, for a Filtering Stone, xxviii 212

Medal, Large Silver, to

Mr. I. Newton, for a Machine for cutting Roots for Cattle, &c. xxvii 135

Hen. Jas. Nicholls, Esq, for an Apparatus for vicious Bulls, xxxiii 42

Mr. P. Nicholson, for a Centro-linead, xxxiii 69

N. H. Nicolas, Esq., for a Semaphore and shifting Key, xxxix 104

Mr. J. Padbury, for a Guard to prevent the Wheel of a Carriage from coming off, xxxi 225

Mr. R. H. Palmer, for a Gage for finding the Center of any regular Polygon, xxxi 247

C. F. Palmer, Esq., M. P. for Sowing Acorns, xxxix 30

Mr. Ed. Parker, for a Single Door Spring, xxxiv 230

Mr. Rich. Parkinson, for his Method of Curing the Foot Rot in Sheep, xxvi 126

Mr. J. Parry, for the Manufacture in England of Leghorn Plat, xl 222

Mr. R. Pering, for an Improved Mud Boat, xxxviii 117

Mr. Jac. Perkins, for his Hose for Fire Engines, xxxviii 102

..... for his Method of Warming and Ventilating Apartments, and the Holds of Ships, xxxviii 80

And Fifteen Guineas, to Mr. Perry, for an Instrument to form the Hand in Writing, xxx 156

Mr. T. Perry, for a Mechanical Calculator, xxxiv 242

J. B. Petre, Esq., for Planting Pinaster Firs, xxviii 33

Mr. R. Phillips, for an Improved Axle for Wheel Carriages, xxxvii 158

Hen. Potts, Esq., for Planting Forest Trees, xxxix 14

Mr. R. Porrett, jun., for Experiments on Prussic Acid, xxvii 89

Mr. Grant Preston, for a Ship's Binacle, xxxi 188

Digitized by Google

Medal, Large Silver, to

Mr. Grant Preston, for a Deck Glass and Ventilator, xxxv 180

Mr. Geo. Prisley, for a Spring Crutch, xxviii 239

And Twenty-five Guineas, to Mr. George Prior, Jun., for a Clock Escapement, xxvii 200

And Ten Guineas, to Mr. Jno. Prior, for a Striking Part of a Clock, xxix 149

Mr. J. Prior, for the Striking Part of a Clock, xxxviii 59

J. Raine, Esq., for Sea Elephant Oil, from New South Wales, xl 238

Mr. J. Rapson, for a Drag for Carriages, xxxiii 137

Hen. W. Reveley, Esq., for a Communication on the Nature and Preparation of Millstones in Tuscany, xl 47

Mr. Robt. Richardson, for a Machine for Drawing Large Stones out of the Earth, xxvi 190

Mr. T. Roberts, for an Improvement in Ship Building, xxvi 173

And Twenty Five Guineas, to Mr. T. Roberts, for a Fire Escape, xxxi 195

Mr. W. Rodger, R. N., for a Plug for Raising Empty Casks, xxxvi 100

Mr. W. Russell, for a Lock for Liquor Cocks, xxxvii 94

And Ten Guineas, to Mr. W. Sampson, for a Churn, xxx 95

Mr. Wm. Salisbury, for Raising Grass Seeds, and laying down Land to Grass, xxvii 67

Mr. Robert Salmon, for a Man-trap, xxvii 181

Mr. G. Savage, for a Detached Escapement, xl 151

Mr. M. Shuldham, Lt. R. N., for a Method of Working a Capstan, xxxiv 198

..... for an Improved Method of Ballasting Vessels, xxxvi 126

Medal, Large Silver, to

C. T. Skurray, Esq., for the Culture of Summer Wheat (Blé Tremais) xxx 73

Mr. Peter Slevin, for his Method of Curing White Herrings, xxix 161

Mr. G. Smart, for a Bow and String Rafter, xxxvii 100

Mr. E. Smith, for Thread from the Common Nettle, xxviii 109

Mr. G. Spark, for a Noctuary, xxviii 234

Mr. K. Spencer, for an Anthropo-Telegraph, xxvii 153

Lieut. J. Spratt, for a Homograph, xxvii 163

Jno. Stephens, Esq., for his Method of Making Bricks, xxix 39

Mr. J. Stephens, for a Forcing Pump, xxxi 235

And Ten Guineas, to Mr. T. Stiles, for Essence of Sprats, xxxv 82

And Five Guineas, to Mr. J. Stone, for a Double Door Spring, xxxii 173

Mr. Jno. Taylor, for a Machine for renewing the Air in Mines, &c., xxviii 219

Mr. R., Thom, for a Hydraulic Self-acting Apparatus to regulate the Supply of Water to Mills, xl 81

Bache Thornhill, Esq., for Planting Forest Trees, xxxiv 74

And Thirty Guineas, to Mr. W. Trengrouse, for an Apparatus for Preserving Persons in case of Shipwreck, xxxviii 161

Mr. E. Turrell, for a Perspectograph, or Instrument for Drawing Objects in Perspective, xxxii 76

And Five Guineas, to Mr. E. Turrell, for a Drawing Board and T Square, xxxiv 139

Mr. J. Varty, for an Improved Axle-tree, xxvii 145

And Ten Guineas, to Mr. W. Warcup, for a Curvagraph, xxxv 109

And Five Guineas, to Mr. H. Ward, for an Equation Work for a Clock, xxxii 144

Digitized by Google

Medal, Large Silver, to

And Ten Guineas, to Mr. T. Warren, for an Engraved Slate, xxvii 172

Mrs. M. A. Warren, for a Piano-Monitor, xxxv 85

H. B. Way, Esq., for Stucco, xxix 73

..... for Turpentine from the Scotch Fir, xxviii 86

Mr. George Webster, for a Method for getting rid of the Steam from Boilers, xxix 145

Mr. Richard White, for a File to Receipts, xxvii 170

Mr. J. Whitford, for an Elastic Truss for Ruptures, xxviii 236

Mr. C. Whitlow, for a Method of Preserving Potatoes at Sea, xxxiii 196

Wigzell, Mr. E., for an Instrument for Marking a Ship's Place on a Chart, xl 158

And Ten Guineas, to Mr. Jas. Wilkinson, for a Turn-wrest Plough, xxxii 38

And Twenty Guineas, to Mr. C. Williams, for a Family Corn Mill, xxxii 102

Mr. G. Williams, for an Improved Method of securing the Beams of Ships, xxvii 142

Mr. R. Williams, for his Methods of Removing the Centering of Arches, xxxiii 127

And Ten Guineas, to Mr. George Wood, for a Parallel Rule, xxxv 113

Mr. Thos. Wood, for an Enclosed Grinding-stone for Needle Pointers, xxix 143

Mr. J. Woodall, for a Bedstead for the Sick or Infirm, xxxii 105

And Twenty Guineas, to Miss Sophia Woodhouse, for a New Material for Straw Plat, xl 217

Medal, Small Silver, to

Mr. A. Ainger, for a Spring Latch, xxxviii 111

Mr. Jas. Allan, for a Machine for Cutting Screws, xxxiv 207

Capt. T. M. Bagnold, for a Cartouch Box, for Naval Service, xxxvii 79

Medal, Small Silver, to

Mr. W. Bailey, for his Mode of Opening and Shutting Church Windows, xl 173

Mr. Ez. Baker, for a Bullet Mould, xxxix 101

..... for a Regulating Screw to the Main-spring of Fire Arms, xl 118

Mr. T. Barker, for an Instrument for Measuring and Laying Down Angles, xxxiv 150

Mr. J. Barrow, for a Single Door Spring, xxxiii 148

And Fifteen Guineas, to Mr. C. Beckway, for a Machine for Weighing and Binding Hay, xxxvii 15

Mr. Miles Braithwaite, for Planting 60,000 Timber Trees, xxx 96

Mr. C. Brandt, for a Spring Crutch for Pendulums, xxxix 108

And Five Guineas, to Mr. W. Bullock, for a Spring Clip for Screens, &c., xxxvii 92

Miss Anne Clague for Raising New Potatoes through the Winter, xxxii 62

Mr. C. Drury, for an Instrument for Feeding Horses while Travelling, xxxii 158

Isaac Espinasse, Esq., for his Management of Bees, xxxvi 27

Mr. Jos. Farey, for a Ball-cock, xxxv 175

Mr. W. Farnham, for a Steam Trap, xxxv 178

Mr. Jas. Fayrer, for a Three Wheeled Clock, xxxvii 138

Jos. Goodwin, Esq., for a Spring Cross for Horses, xxxix 110

Henry Gordon, Esq., Captain, R. N., for a Life Boat, xl 73

Henry Grant, Esq., for Embanking Land from the Sea, xxxv 38

Mr. R. Green, for a Plough-gage for Cutting Leather, xxxvii 89

Mr. Ar. Harrison, for a Parallel Rule for Engravers, xxxviii 45

And Five Guineas, to Mr. J. Henlon, for a Single Door Spring, xxxvi 71

Digitized by Google

Medal, Small Silver, to

Major Bryan Hesledon, for Improving Waste Land, xxx 40

The Earl of Jersey, for Embanking Land from the Sea, xxxv 38

And Five Guineas, to Mr. R. King, for an Improved Mode of Constructing Anvils, xxxviii 78

Mr. S. Lake, for a Double Door Hinge, xxxix 135

And Ten Guineas, to Mr. St. Marshall, for a Calico Printer's Block, xxxii 85

And Ten Guineas, to Mr. W. Martin, for an Index Weighing Machine, xxxii 157

J. H. Moggridge, Esq., for Experiments on the Growth of Forest-Trees, xxx 49

Mr. R. Onwin, for a Banding Plane, xxxv 122

C. F. Palmer, Esq. M. P., for Planting Forest-Trees, xxxvii 11

Mr. R. Pering, for a Wrought-Iron Gun-carriage, xl 54

And Twenty Guineas, to Mr. J. Prior, for the Striking part of a Clock, xxxv 138

Mr. G. Prior, for a Method of preventing Accidents in descending Mines, xxxvi 77

Mr. C. Pye, for a Method of Preparing Charcoal for Drawing with, xxxiv 129

J. Raine, Esq., for Wool from Van Dieman's Land, xl 238

Mr. D. Redman, for Lithography executed on English Stone, xxxvii 58

And Ten Guineas, to Mr. G. Rhodes, for a Frame for Drying Woollen Warps on, xxxvii 75

Ben. Rotch, Esq., for an Arcograph, xxxix 49

Mr. Wm. Salisbury, for Matting, and other articles made of the Typha Latifolia, xxxix 52

Mr. T. Scorrar, for his Improved Machine for Blocking Straw Hats, xxxiv 163

Medal, Small Silver, to

And Ten Guineas, to Mr. J. Skinner, for an Instrument for Sweeping Chimnies, xxxviii 73

Mr. Ed. Smith, for Cloth from Nettle Fibres, xxix 81

And Five Guineas, to Mr. J. Smith, for an Improved Umbrella Joint, xxxviii 72

Mr. G. Steart, for Tablets for Drawing on, xxxix 43

Mr. Henry Stokes, for a Hydrometer for Spirits, xxxviii 27

Mr. James Story, for a Portable Oven, xxxix 73

Mr. James Swaine, for an Iron Finger-Post, xxxi 240

H. B. Way, Esq., for Preserving Carrots during the Winter Months, xxxiii 45

Mr. C. West for a Parallel Rule, xxxiv 137

And Ten Guineas, to Mr. James White, for a Double Door Spring, xxxvii 102

Mr. J. Whitford, for a Mechanical Substitute for Leeches, xxxi 229

Mr. J. Watson, for a System of Musical Notation for the use of the Blind, xl 78

And Five Guineas, to Mr. A. Young, jun., for a Fire Escape, xxxi 244

Meek, M. Esq., on Planting Forest Trees, xxxiv 67

Meigh, J. Esq., on a Glaze for Common Red Earthenware, xl 44

Meter, Gas. See *Gas-Meter*

Mill, Corn. See *Corn Mill*

Miller, J. Esq., Instrument for Preserving Persons from Drowning when the Ice breaks, xxxii 194

..... on a Drag for Raising Drowned Bodies, xxvii 125

Millikin, Mr. J., on an Improved Bistoury, xl 69

Digitized by Google

Mills, supply of Water to, regulated by a Self-acting Hydraulic Apparatus, by Mr. R. Thom, xl 78

Millstone, Fine, a Quarry of, in Halkin Mountain, Flintshire, xxxix 55

Millstones of Tuscany, Communication on, by H. W. Reveley, Esq., xl 47

Mineralogical Map. See *Map*

Mines, Method of Preventing Accidents in Descending, by Mr. G. Prior, xxxvi 77

..... Mr. John Taylor's Machine for Ventilating, xxviii 219

Mitchell, Alexander, Esq., on Specimens of Scotch Granite, xxviii 71

Moggridge, J. H. Esq., Experiments on the Growth of Forest Trees, xxx 49

Monk, Mr. James, on Diminishing the Risk of Explosion in Gunpowder Mills, xxxvii 161

Mooring-block. See *Anchor*

Morrison, Mr. G., on Implements for the use of Persons who have lost their Hands, xxviii 241

Motion, Rotatory, on a Method of Communicating, by the Chev. Baader, xxxiv 193

Moult, Mr., on a Filtering Stone, xxviii 212

Mud-Boat, an Improved, by Mr. R. Pering, xxxviii 117

Murry, Matthew, Esq., on a Machine for Hackling Hemp or Flax, xxvii 148

Musical Instruments.—

Mr. M. Levien's Harp Guitar, xxxii 117

Mrs. M. A. Warren's Piano-Monitor, xxxv 85

Mr. J. Barraud's Violoncello, xxxvii 67

Mr. M'Gregor's German Flute, xxxi 215

Musical Notation, System of, for the use of the Blind, by M. Cooke, xxx 143

..... by Mr. J. Watson, xl 78

Napier, Mr. D., on a Tracing Instrument, xxxvii 63

Navigation, Instrument for Working Problems in, by Mr. T. Pering, xxxiv 200

Needle-pointing. See *Grinding Dry*,

Nettles, Thread from. See *Fibre Vegetable*

Newton, Mr. Thomas, on a Machine for Cutting Roots for Cattle, &c. xxvii 135

Nicholls, Henry James, Esq., on an Apparatus for Vicious Bulls, xxxiii 42

Nicholson, Mr. P., on a Centro-linead for Drawing in Perspective, xxxii 67 xxxiii 69

..... on a Method of Squaring a Hand-rail, xxxii 121

Nicolas, N. H. Esq., on a Semaphore and Shifting Key, xxxix 104

Noctuary. See *Clock*

Numbers, Mr. Goss's Instrument to Perform Addition of, xxx 159

Nutmegs, in the Botanic Garden at St. Vincent's, xxviii 313

Oaks. See *Plantations*

..... on the best Method of raising, for Timber, by the Duchess of Rutland, xxxiii 33

Octant, sinical, by Mr. L. Byron, xxxii 111

Ogden, Mr. James, on an Improved Pruning Instrument, xxx 89

..... on Improved Garden-shears, and Pruning Instruments, xxxiii 40

Oil, Cocoa-nut, Importation of, by T. Hoblyn, Esq., xxxiii 60

.... Whale, Purification of, by Mr. J. Baker, xxxiii 65

..... Press for Extracting, by Messrs. Bramah, xxxiv 261

Oil Paintings. See *Paintings*

Onwin, Mr. R., on a Banding Plane, xxxv 122

Digitized by Google

Opium, British, on the Preparation of by J. Young, Esq., xxxvii 23—xxxviii 21

..... by Messrs. Cowley and Staines, xl 9

Orchard, 50 Acres of, Planted by Mr. Samuel Curtis, xxvi 123

Orrery, Hydraulic, by Mr. C. A. Busby, xl 98

Oven, Portable, by Mr. James Story, xxxix 73

Ox Gall, prepared for Painters, xxviii 106

..... rendered Colourless, by Mr. P. W. Tomkins, xxxi 130

Padbury, Mr. J., on a Guard to prevent the Wheel of a Carriage from coming off, xxxi 225

Painting, Drawing, Sculpture; Instruments and Inventions for Persons engaged in—

Easel, Portable, for Painters, by Mr. F. Williams, xxxi 144

..... by Mr. C. Varley, xxxiii 82

Instruments for Drawing in Perspective, by Mr. E. Turrell, xxx 76

..... Mr. J. Farey, jun., xxxii 71

..... by Mr. D. Dick, xxxv 89

Centro-linead by Mr. P. Nicholson, xxxii 67—xxxiii 69

Ellipses, Instrument for Drawing, by Mr. J. Farey, jun., xxxi 117

..... Mr. W. Cubitt, xxxiv 131

..... Mr. James Clement, xxxvi 133

Center of a Circle or Polygon, Instrument for finding, by Mr. R. H. Palmer, xxxi 247

Curvagraph, by Mr. W. Warcup, xxxv 109

Angulometer, by Mr. T. Barber, xxxiv 150

..... Mr. W. Hall, xxxv 114

Parallel Rule, by Mr. West, xxxiv 137

..... by Mr. G. Wood, xxxv 113

Painting Drawing, &c.

Parallel Rule for the use of Engravers, by Mr. Ar. Harrison, xxxviii 45

Tracing Instrument, by Mr. Napier, xxxvii 63, xxxix 171

Arcograph, by B. Rotch, Esq., xxxix 49

T Square, by Mr. E. Turrell, xxxiv 139

Reticulated Square, Mr. T. Allason's, xxxiv 145

Instrument for Transferring the Points in Sculpture, by Mr. W. Behnes, xxxvii 172

Ivory Paper, by Mr. Einsle, xxxvii 59

Paper Tablets, Solid, by Mr. G. Steart, xxxix 43

Paintings in Oil, Mr. Wilson's Method of Preserving, xxxi 142

Palmer, C. F. Esq., M. P., on Planting Forest Trees, xxxvii 11, xxxix 6

..... on Sowing Acorns, xxxix 30

..... on Planting Oaks, xxxix 1

..... Mr. R. H., on a Gage for finding the Center of any Regular Polygon, xxxi 247

Paper for Drawing on. See *Painting*

Paper, Ivory, Preparation of, by Mr. Einsle, xxxvii 59

Paper, Transparent, Mr. Cathery's, xxx 116

Parallel Rule. See *Painting and Drawing*

Park, Mr. J., on a Mooring Block, xxxvi 84

Parker, Mr. Ed., on a Single Door Spring, xxxiv 230

Parkinson, Mr. Richard, on Curing the Foot-rot in Sheep, xxvi 126

Parry, Mr. J., on the Manufacture in England of Leghorn Plat, xl 222

Digitized by Google

Parsnips, Cultivation of, in the Island of Jersey, and their Use in Feeding Cattle, xxvii 52

Paste, for Book-binders, &c. from Potatoes, xxxi 113

Peart, J. Esq., on reclaiming Waste Land, xl 1

Peat, Captain J., on a Temporary Rudder, xxxi 161

Peat-moss. See *Waste Land*

Pecuniary Rewards. See *Rewards*

Pendulum. See *Clock*

..... Inverted Spring, by Mr. W. Hardy, xxxvii 147

Pepper, Black, Dr. Anderson, on the Cultivation of, in St. Vincent's, xxvii 228

Percussion Gun Lock. See *Gun Lock*

Pering, Mr. T., on an Instrument for Working Problems in Navigation, xxxiv 200

Pering, Mr. R., on an Improved Mud-boat, xxxviii 117

..... on a Wrought-Iron Gun-carriage, xl 54

Perkins, Mr. Jac. on Ventilating Apartments and the Holds of Ships, xxxviii 80

..... his Improved Hose for Fire Engines, xxxviii 102

..... on a Ship's Pump, xxxviii 106

..... on Drawing off the Back-water from Water Wheels, xxxviii 109

..... on two Instruments for Ascertaining the Trim of Ships, xxxix 126

..... on a Stove for Ventilation, xxxix 133

Perkins, *Fairman* and *Heath*, Messrs. on Engraving on Steel, xxxviii 47

Perry, Mr. T., on a Mechanical Calculator, xxxiv 242

Perspective, Instruments for Drawing in. See *Painting*

Petre, J. B. Esq., on Planting Pinaster Firs, xxviii 37

Phillips, Mr. L. jun., on Planting hardy Fruit Trees, xxxi 64

..... on the Culture and Uses of Mangel-wurzel, xxxii 48

Phillips, Mr. R., on an Improved Axle for Carriages, xxxvii 158

Piano-Monitor, Mrs. M. A. Warren, on a, xxxv 85

Pipes, *Water*. See *Water Pipes*

Plane, Banding, a, by Mr. R. Onwin, xxxv 122

Plantations—

General Observations on the Management of, especially of Larch Plantations, by T. White, Esq., xxxi 91

Of Acorns, in the Parish of Aldermaston, Berks, by W. Congreve, Esq., xxxiv 64

Of Oaks, at Scone, near Perth, by the Earl of Mansfield, xxvi 25

Of Oaks, in the Parish of Aldermaston, Berkshire, by W. Congreve, Esq., xxvii 30

Of Oaks, at Kirkby cum Osgodby, in Lincolnshire, by H. Andrews, Esq., xxix 30

Of Oaks, near Pickering, Yorkshire, by W. Liddell, Esq., xxxii 25

Of Oaks, in Windsor Forest, near Wokingham, Berks, by C. F. Palmer, Esq. M. P., xxxix 1

Of Oaks, in the Parish of Shute, Devon, by Sir W. Templer Pole, Bart., xxxix 3

Of Firs at Heffleton, Dorsetshire, by A. Bain, M. D., xxix 25

Of Pinaster Firs, at Westwich Park, Norfolk, by J. B. Petre, Esq., xxviii 33

Of Forest Trees, in the Parish of Wokingham, Berks, by C. F. Palmer, Esq., M. P. xxxix 6

Of Forest Trees, on Inglewood Forest, Cumberland, by the Duke of Devonshire, xxxviii 1

Digitized by Google

Of Forest Trees in the Parish of Llanferres, Denbigh, by Hen. Potts, Esq., xxxix 14

Of Forest Trees at Heffleton, Dorsetshire, by A. Bain, M.D., xxvi 41

..... in Denbighshire and Merionethshire, by W. M. Thackeray, M.D., xxvii, 25 xxxvii 1

..... at Grizedale, Lancashire, by H. Ainslie, M. D., xxx 25

..... at Hawkshead, Lancashire, by Mr. M. Braithwaite, xxx 96

..... at Great Broughton, near Stokesley, York, by M. Meek, Esq., xxxiv 67

..... at Stanton in the Peak, Derbyshire, by B. Thornhill, Esq., xxxiii 33, xxxiv 74

..... in the Parish of Llangollen, Denbigh, by Sir W. W. Wynne, Bart., M.P., xxxvi 18

..... at Dotterill, near Beverley, York, by Ralph Creyke, Esq., xxxvi 22

..... at Kilham, Yorkshire, by R. Creyke, Esq., xxxvii 9

..... on Windsor Forest, by C. F. Palmer, Esq., M.P., xxxvii 11

Of Fifty Acres of Orchard, at Bradwell, Essex, by Mr. S. Curtis, xxvi 123

Of Fruit Trees, in Surrey, by Mr. L. Phillips, Jun, xxxi 64

Of Larches, on Birkfell, near Newbybridge, Lancashire, by the Bishop of Llandaff, xxvi 27

..... on Clar Common, Workington, by J. C. Curwen, Esq., M.P., xxvii 21

..... at Hafod, Cardiganshire, by Thos. Johnes, Esq., M.P., xxviii 30

..... on Blidworth Forest, Nottinghamshire, by H. Cowlishaw, Esq., xxix 36

Of Larches, in the Parish of Aldermaston, Berkshire, by W. Congreve, Esq., xxix 34

..... near Walsingham, Durham, by W. Backhouse, Esq., xxxi 66

..... in the Parish of Lanchester, Durham, by Jon. Backhouse, Jun., Esq, xxxi 70

..... in the Parish of Walsingham, Durham, by E. Backhouse, Esq., xxxii 32

..... and other Forest Trees, in the Counties of Denbigh and Merioneth, by J. M. Jones, Esq., xxxi 36

..... and Fir, in Banffshire, by P. Steuart, Esq., xxxi 43

..... in the Parish of Drumblade, Aberdeenshire, by J. Lawson, Esq., xxxv 35

Plough for breaking up Waste Land preparatory to Planting, by C. F. Palmer, Esq., M.P., xxxix 12

Plants, living, conveyed by Sea, effects of packing them in *Sphagnum Palustre*, xxx 198

..... Method of Packing, by Mr. Wm. Salisbury, xxvii 40

..... growing, management of, at Sea, xxvii 237

Plat, Leghorn, Manufacture of, in England, by Mr. J. Parry, xl 222

..... Method of Knitting, xl 225

..... Straw, new material for, xl 217

Plates, List of

Vol. xxvi

Frontispiece; Portrait of the late Duke of Richmond, V. P. of the Society

No. 1. Mr. Mason's Trochar for Hoven Cattle; Mr. Fisher's Churn Staff; and Mr. Tansley's Cutter for making Silk Shag

2. Captain Ball's Improved Anchor; Capt. Ball's Method of Fishing an Anchor; and Capt. Bolton's Improved Jury Mast.

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3. Mr. Roberts's Method of securing the Beams of Ships by Iron Knees
4. Major Le Hardy's Telegraph
5. The Chevalier Edlecrantz's Telegraph
6. Mr. Richardson's Machine for Drawing large Stones out of the Ground
7. Mr. Tad's Rising Spring for Doors; and Mr. Barlow's Wrench for Screw Nuts
8. Mr. Clegg's Apparatus for making Coal Gas
9. Mr. Ward's Crank for a Telegraph; and Captain Manby's Apparatus for Saving the Lives of Shipwrecked Persons
10. Application of Captain Manby's Apparatus

Vol. xxvii

Frontispiece; Portrait of the Late Earl of Liverpool, V.P. of the Society

No. 1. Mr. Lester's Potatoe Washer; and Mr. Salisbury's Method of Training Trees
2. Mr. Saddington's Machine for Covering Wire with Silk
3 Mr. Miller's Drag for Drowned Bodies
4. Mr. Miller's Drag for Drowned Bodies; and Mr. Newton's Machine for Chopping Meat or Roots
5. Captain Bolton's Jury Mast
6. Mr. Williams's Method of connecting the Beams of Ships with the Sides; and Mr. Varty's Axle-tree
7. Mr. Murry's Machine for Hackling Hemp
8. Mr. Spencer's Anthropo-Telegraph
9. Lieut. Spratt's Homograph; Mr. White's Letter File; and Mr. Warren's Engraved Writing Slate
10. Mr. Brockbank's Machine for Making Slate Pencils

PLA

11. Mr. Salmon's Earthen Walls and Man-trap
12. Mr. Prior's Escapement; and Mr. Ross's Eye Bath
13. The Sheffield Apparatus for Sweeping Chimnies

Vol. xxviii

Frontispiece; Portrait of the late Duke of Portland, V.P. of the Society

No. 1. Mr. Lee's Thrashing Machine
2. Mr. Ball's Screw Adjusting Plough; Mr. Baker's Thistle Extirpater; and Mr. Jeffrey's Expanding Harrow
3. Mr. Cook's Apparatus for Distilling Coal; and Mr. Way's Method of obtaining Turpentine
4. Mr. Sholl's Silk Weaver's Drawboy
5 Rev. Mr. Bremner's Life Boat; and Mr. Hemman's Mooring Block
6. Mr. Davis's Fire Escape
7. Mr. Allan's Mathematical Dividing Machine
8. Mr. Donkin's Tachometer
9. Mr. Aubery's Machine for Cutting Leather Straps
10. Mr. Williams's Machine for Boring Conical Holes in Brass
11. Mr. Baker's Pistol for Cavalry
12. Mr. Ross's Magnetic Hammer; and Mr. Marshall's Swinging Window Sash
13. Mr. Moult's Filtering Apparatus; Mr. Smith's Method of relieving a Fallen Horse from the Shafts; and Mr. Taylor's Machine for Ventilating Mines
14. Mr. Reid's Compensation Pendulum; and Mr. Spark's Noctuary
15. Mr. Whitford's Truss; Mr. Prisley's Spring Crutch; and Mr. Morrison's Instruments for those who have lost their Hands
16. Mr. Morrison's Instruments for those who have lost their Hands

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17, 18. Manufacture of East Indian Indigo

Vol. xxix

Frontispiece; Portrait of the late Caleb Whitefoord, Esq., V.P. of the Society

No. 1. Mr. Jones's Corn Rick; and Mr. Stevens's Bricks

2. Mr. Jones's Corn Rick; and Mr. Waistel's Dibble for Planting Acorns

3. Mr. J. Robertson's Machine for Weaving Tartan Hose

4. Capt. Bagnold's Method of elevating and depressing Cannon

5. Mr. W. Brunton's Pump for Well-Sinkers

6. Mr. Allan's Reflecting Circle

7. Mr. Hodgson's Mariner's Compass

8. Mr. H. Earle's Bedstead for Invalids; and Mr. J. Fuller's Scarificator

9. Mr. G. Prior's Clock Escapement; and Mr. R. Bridgen's Gilder's Head-piece

10. Mr. Wood's enclosed Grindstone for Needle Pointers; and Mr. G. Webster's Method of getting rid of the Steam of Boilers

11. Mr. Jno. Prior's Striking part of a Clock

Vol. xxx

Frontispiece; Portrait of the late Charles, Earl of Romney, V.P. of the Society

No. 1. Mr. Hodge's Pot for Preserving Butter; Mr. Ogden's Pruning Implement; Mr. Sampson's Churn

2. Mr. Beard's Machine for Cutting and Crooking Wire for Cards

3. Mr. Cooke's Machine for Teaching Music to the Blind

4. Mr. Machell's Annular Saw

5. Mr. Bowler's Rat-trap; Mr. Perry's Instrument for Forming the Hand in Writing

PLA

6. Mr. Goss's Machine for Adding Numbers

7. Mr. Davis's Temporary Scaffold; Mr. Martin's Method of relieving a fallen Horse from the Shafts

8. Mr. Ritchie's Compensation Pendulum; Mr. King's Machine for Boot and Shoe Makers

9. Dr. Cumming's Vapour Bath

Vol. xxxi

Frontispiece; Portrait of the late George, Earl of Dartmouth, V.P. of the Society

No. 1. Mr. Whatley's Machine for Grinding Potatoes

2. Mr. Hughes's Moveable Scaffold for Domes; Mr. Green's Potatoe-Scoop

3. Mr. Whitford's Mechanical Substitute for Leeches; Mr. Tilley's Blow-pipe

4, 5. Mr. J. Farey's Ellipsograph

6. Mr. Williams's Painters' Easel; Mr. Young's Fire Escape

7. Mr. Barralet's Shop-board for Tailors; Mr. Davis's Stove for Burning Wood Shavings

8. Captain Peat's temporary Ship's Rudder

9. Mr. Preston's Ships' Binacle and Lamp

10, 11. Mr. Roberts's Fire Escape

12. Mr. Prior's Wheel for Needle Pointers

13. Mr. Douglas's Instrument for Firing Cannon; Mr. M'Gregor's German Flute

14. Mr. Hughes's Axle for Water Wheels; Mr. Padbury's Guard for a Carriage Wheel

15. Mr. Swaine's Finger Post; Mr. Stephens' Forcing Pump

16. Mr. Palmer's Center-gage; Mr. Stone's Expanding Center-bit

17. Mr. Durand's Machine for Dressing Hemp

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PLA

Vol. xxxii

Frontispiece; Portrait of the late Sir W. Dolben, Bart., V.P. of the Society

1. Mr. Braby's Cart and Drag; Mr. Wilkinson's Turnwrest Plough

2. Mr. Nicholson's Centro-linead; Mr. J. Farey's Perspective Instrument; Mr. E. Turrell's Do.

3. Mr. Marshall's Block for Calico Printers

4, 5. Mr. Hookey's Machine for bending Ship Timber

6. Mr. Hedderwick's Double Piston Pump

7. Mr. Williams's Family Mill

8. Mr. Woodall's Bedstead for the Sick; Mr. Laurence's Crutch for the Lame

9. Mr. Byron's Sinical Octant; Mr. Levien's Harp-guitar

10, 11, 12. Mr. Nicholson's Method of Squaring Hand Rails

13. Mr. Ward's Equation Work for a Clock

14. Mr. Horn's Machine for Cutting Canvas; Mr. Martin's Weighing Machine; Mr. Drury's Horse-feeder

15. Mr. Folsch's Glass Tablet; Mr. Keyworth's Horn Do.

16. Mr. Wilson's Sash Window; Mr. Stone's Double Door Spring

17. Mr. Boyce's Life Buoy; Mr. Cleghorn's Buoyant Line; Mr. Miller's Machine for Saving Persons from Drowning; Mr. Scott's Clasp for Standing Rigging

18. Mr. Boyce's Life Buoy; and Mr. Cleghorn's Buoyant Line, in Action

Vol. xxxiii

Frontispiece; W. Roxburgh, M.D.

No. 1. Mr. Ogden's Pruning Shears; Mr. Nicholls's Apparatus for Vicious Bulls

PLA

2. Mr. Bowler's Machine for Dressing Grain

3. Mr. Hoblyn's Apparatus for Extracting Cocoa-nut Oil

4. Mr. P. Nicholson's Centro-linead

5. Mr. Fulton's Protractor

Mr. C. Varley's Painter's Easel

6. Mr. Jones's Machine for serving Ship's Ropes

Mr. Scorrar's Machine for Blocking Straw Hats

7. The Chev. Assalini's Instruments for Lithotomy

8. ..... Obstetrical Instruments

9. ..... Amputating Instruments

10. ..... Sundry Surgical Instruments

11. Mr. Hyslop's Lancet for opening Abscesses

Mr. W. Franklin's Double Piston Pump

12. Mr. A. Davis's Telegraph

Mr. Law's Screw for securing Gun-carriages

13. Mr. Buck's Instrument for Examining Ships Bottoms

Mr. Williams's Method of Removing the Centering of Arches

14. Mr. Rapson's Drag for Carriages

Mr. B. Clark's Hobbles for Horses

15 Mr. London's Hydrometer

Mr. Braby's Domestic Balance

Vol. xxxiv.

Frontispiece; Charles Duke of Norfolk, late President of the Society

No. 1. Mr. G. Field's Filtering Apparatus

2. ..... Drying Stove

3. }
4. } Mr. Ryan's Method of Venti-
5. } lating Coal-mines
6. }

7. Dr. Clanny's Safe Lamp

8. Mr. W. Cubitt's Instrument for drawing Ellipses

9. Mr. C. West's Parallel Rule

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10. Mr. E. Turrell's Drawing Board and T Square
11. Mr. Allason's Perspectograph
12. Mr. Barber's Angulometer
13. Mr. T. Scorrar's Improved Machine for Blocking Straw Hats
14. } Admiral Sir H. Popham's
15. } Telegraph
16. Dr. Cartwright's Traversing Apparatus
17. Capt. Le Hardy's Method of Communicating from a Ship with the Shore
18. Mr. Goodwin's Probang for Horses

Mr. Bremner's Instrument for making Ligatures

19. } Lieutenant Shuldham's Pulley-
20. } blocks
21. }
22. The Chev. Baader's Method of Communicating Rotatory Motion

Lieut. Shuldham's Capstan

23. Mr. Jas. Allan's Engine for cutting Screws
24. ..... Theodolite
25. Mr. Braby's Fire Escape

The Rev. J. Bremner's Day Telegraph

26. Mr. E. Parker's Single Door Spring
27. Mr. Roberts's Ventilator for Needle Pointers
28. } Mr Dickson's Apparatus for
29. } Propelling Steam-boats
30. Mr. Bramah's Oil Press
31. } Mr. Maudsley's Mill for Decor-
32. } ticating Rice

Vol. xxxv.

Frontispiece; C. Taylor, Esq., late Secretary to the Society

No. 1. Dr. Clanny's Steam Safe-lamp

2. Mrs. M. A. Warren's Piano-monitor
3. Mr. Dick's Perspective Instrument

PLA

4. Mr. Warcup's Curvograph

Mr. Wood's Parallel Rule

Mr. Hall's Angulometer

5. } Mr. Saddington's Machine for
6. } Covering Wire
7. Mr. Onwin's Banding Plane
8. } Mr. Wynn's Time Keeper and
9. } Compensation Pendulum
10. }
11. Mr. Prior's Striking Part of a Clock
12. } Mr. Jas. Jones's Self-adjusting
13. } Crane
14. Mr. Barchard's Cylindrical Rake
15. } French Portable Corn Mill
16. }
17. Mr. Aust's Method of Relieving a Fallen Horse from the Shafts
18. Mr. T. Coad's Machine for Shoe Makers
19. Mr. Caslon's Gas-lamp
20. Mr. Essex's Winnowing Machine
21. Capt. Bray's Life-boat
22. Mr. Preston's Deck-glass and Ventilator

Mr. Farnham's Steam Trap

Mr. Jas. Farey's Double-ball Cock

23. Mr. Wilson's Machine for Sweeping Chimnies
24. Capt. Bagnold's temporary Ship's Rudder
25. Dr. D. Davis's Craniotomy and Polypus Forceps
26. } Mr. Conolly's Telegraph
27. }

Vol. xxxvi.

Hugh, Duke of Northumberland, late V. P. of the Society

No. 1. Mr. Common's Double Drill Turnip Sower

2. Mr. Grant's Life Preserver
3. Mr. Henlon's Door Spring
4. Mr. Lane's Pen-holder and Ruler

Mr. Brierley's Stretch for Woollen Warps

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5. Mr. Prior's Apparatus for Preventing Accidents in Descending Mines

6. } Mr. Ramshaw's Apparatus for
7. } Heating Copper Plates by Steam

8. Mr. Hall's Percussion Gun Lock

Mr. Park's Mooring Block

9. Mr. Conolly's Portable Telegraph

Lieut. Rodger's Plug for Raising empty Casks

10. } Mr. Jas. Jones's Pulley Blocks
11. }

12. Mr. Lane's Turning Lathe

13. Mr. Somerford's Door Lock

14. Mr. D. Ritchie's Pendulum Crutch

15. Mr. T. Cook's Night Life Buoy

16. Lieut. Shuldham's Method of Ballasting Vessels

17. }
18. }
19. }
20. }
21. } Mr. Clement's Instrument for
22. } Drawing Ellipses
23. }
24. }
25. }
26. }

Vol. xxxvii.

Frontispiece; H. R. H. The Duke of Sussex, &c., President of the Society.

1. } Mr. Beckway's Machine for
2. } Binding Hay

3. Mr. Lane's Fruit-gatherer

Mr. Young's Implements for collecting Opium

4. Mr. Roberts's Churn

5. Mr. Napier's Tracing Instrument

6. Mr. Barraud's Violoncello

7. Capt. Bagnold's Cartouch Box

Mr. Brabazon's Row-lock

Mr. Rhodes's Machine for Drying Woollen Warps

8. Mr. Bell's Universal Chuck for Turners

PLA

9. Mr. Hack's Universal Chuck for Turners

10. Mr. Green's Plough-gage for cutting Leather

Mr. Bullock's Spring Clip

11. } Mr. Russell's Lock for Liquor-
12. } cocks

13. Mr. Smart's Bow and String Rafter

Mr. White's Double Door Spring

14. } Mr. Cuthbert's Chemical Hydro-
15. } pneumatic Apparatus

16. Lieut. Cook's Life-raft

17. Lieut. Rodger's ditto

18. } Mr. Donkin's Counting Ma-
19. } chine

20. Mr. Ainger's Self-adjusting Crane

21. Mr. Feetham's Chimney-sweeping Apparatus

22. Mr. Senefelder's Portable Lithographic Press

23. } Mr. Aust's Pump
24. }

25. Mr. Fayrer's Clock

26. Mr. Hardy's Spring Pendulum

27. Mr. Taylor's Alarum Clock

28. } Mr. Phillips's Axle
29. }

30. Mr. Monk's Gunpowder Mill

31. Mr. Malam's Gas-meter

32. } Mr. Behnes's Machine for
33. } taking out the Points in Sculpture

Vol. xxxviii.

Frontispiece; H. R. H. The Duke of Kent, &c. &c.

No. 1. Mr. Stokes's Hydrometer

Mr. Bullock's Ball Valve

2. Mr. Prior's Striking Part of a Clock

3. Mr. Holdsworth's Roofs

4. Mr. Austen's Method of Adjusting the Bedstone of a Corn Mill

5. Mr. White's Double Door Spring

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Mr. Harrison's Parallel Rule
Mr. Smith's Umbrella Joint
6. Mr. Skinner's Machine for Sweeping Chimnies
Mr. Gorman's Spring Bandage
Mr. King's Anvil
7. 8. Mr. Perkins's Method of Ventilating and Warming
9. 10. Mr. Jopling's Method of Constructing Groined Arches
11. 12. Messrs. Jeffries' and Halley's Blowing Machine
13. Mr. Cherry's Springs and Blocks for Carts
14. Mr. Ainger's Door Lock
15. Mr. Jenning's Log Glass
Mr. Jamieson's Marine Thermometer Case
16. Mr. Perkins's Hose for Fire Engines
17. Mr. Perkins's Ship's Pump
18. Mr. Pering's Mud-boat
19. 20. Mr. Perkins's Method of Freeing Water Wheels from Back Water
21. Capt. Stack's Apparatus for the use of those who have Lost an Arm
22. 23. 24. 25. Mr. Hookey's Rudders
26. Mr. Hookey's Method of Forming the Knees and Timbers of Boats
27. Mr. Hookey's Chain Beams for Ships
28. Capt. Burton's Method of Propelling large Ships, and of Working the Pumps
29. 30. Mr. Elliott's Safe Coach
31. 32. Mr. Davies's Sun Dial
33. Mr. Trengrouse's Apparatus for Rescuing Persons from a Stranded Ship

PLA

34. 35. 36. 37. 38. Mr. Hardy's Time-keeper
39. 40. Mr. Perkins's Siderographic Engraving

Vol. xxxix.

No. 1. Mr. Palmer's Ploughs for Breaking up Waste Land
Mr. Rotch's Arcograph
2. Mr. Barlow's Apparatus for correcting the Variation of the Compass
3. Mr. Rider's Machine for cutting Tips for Hats
Mr. Story's Portable Oven
4. Mr. Baker's Bullet Mould
Lieut. Nicolas's Semaphore
Mr. Brandt's Spring Pendulum-crutch
5. Mr Goodwin's Cross for Horses
6. Mr. Witty's Fire Escape
7. Mr. Perkins's Stove
Mr. Lake's Door Hinge
8. Mr. Perkins's Instruments for finding the Trim of a Ship
9. Mr. Earle's Bed for Patients under Surgical Treatment
10. 11. Mr Allan's Machine for Dividing Circular Arcs

Vol. xl.

No. 1. Messrs. Cowley and Staines's Instruments for Gathering Opium, &c.
Mr. Marshall's Blocks for Calico Printers
2. Mr. Pering's Gun-carriage
Mr. Biddle's Hay-borer
3. Mr. Richards's Draw-boy
4. 5. 6. 7. Mr. Thompson's Ribbon Loom
8. Mr. H. W. Reveley's Tuscan Millstones

Digitized by Google

9. Mr. Holditch's Life Beacon
Mr. Goodwin's Bridle-bit
Mr. Millikin's Bistoury
10. Lieut. Littlewort's Compass
Capt. Gordon's Life Boat
11. Mr. Watson's Music Board for the Blind
12. 13. 14. Mr. Thom's Hydraulic Apparatus for regulating the Supply of Water to Mills
15. Mr. Busby's Hydraulic Orrery
16. Mr. Wynn's Hammer for a Turret Clock
17. Mr. Bowler's Rat Trap
Mr. Baker's Gun Lock
18. Mr. Hookey's Coffer for Repairing Ships Afloat
19. Mr. Hall's Steam Engine Boiler
20. Mr. Wigzell's Instrument for marking a Ship's Place on a Chart
21. Mr. Bailey's Plan for Opening Church Windows
22. Mr. Savage's Clock Escapement
23. Mr. Abraham's Magnetic Guard for Dry Grinders
24. Mr. Ainger's Hydrometer
The Method of Knitting Leghorn Plat
Diagram relating to Mr. Rotch's Arcograph

Plough. See *Agricultural Instruments*

Plough-gage. See *Leather*

Pole, Sir W. Templer, Bart., on Planting Oaks, xxxix 3

Popham, Admiral Sir H., on a Telegraph and Marine Vocabulary, xxxiv 167

..... on a System of Cutting Flags, xxxiv 173

Porcelain, Glaze for, by Mr. J. Rose, xxxviii 42

Porrett, Mr. R. Jun., on Prussic Acid, xxvii 89

Potatoes, Culture of, by J. C. Curwen, Esq. M. P., xxvi 79

..... Method of obtaining new ones through the Winter, by Miss Anne Clague, xxxii 62

..... Method of Preserving at Sea, by Mr. C. Whitlow, xxxiii 196

..... Mr. Green's Instrument for Scooping out the Eyes of, xxxi 74

..... Machine for Washing, by Mr. Wm. Lester, xxvii 34

..... Machine for Grinding, by J. Whatley, Esq. xxxi 46

..... Bread made of, Comparative Experiments on, xxxi 55

..... Preparation of strong Paste from, by Mr. C. Drury, xxxi 113

Potts, Hen. Esq., on Planting Forest Trees, xxxix 14

Premiums adjudged to. See *Rewards*

Preparations, Anatomical. See *Anatomical Preparations*

Preserving Fruit without Sugar, by Mr. T. Saddington, xxvi 145

Press, Messrs. Bramah's Hydro-mechanical for Extracting Oil, xxxiv 261

..... Portable Lithographic, by Mr. R. Ackermann, xxxvii 131

Preston, Mr. G., on a Ship's Binacle, xxxi 188

..... on a Deck-glass and Ventilator, xxxv 180

Prior, Mr. Geo. on a Clock Escapement, xxvii 200

..... on an Improved Escapement, xxix 133

..... on a Guard for Needle Pointers, xxxi 206

..... on a Method of Preventing Accidents in Descending Mines, xxxvi 77

..... Mr. J., on the Striking Part of a Clock, xxix 149—xxxv 138—xxxviii 59

Prisley, Mr. G., on a Spring Crutch, xxviii 239

Digitized by Google

Pritchard, Mr. W., on the use of Buffalo Wool in Hat Making, xl 228

Probang, for giving Medicine to Horses, by Jas. Goodwin, Esq., xxxiv 235

Protractor, by Mr. H. Fulton, xxxiii 84

Pruning Instrument, by Mr. Jas. Ogden, xxx 89, xxxiii 40

Prussic Acid, Mr. R. Porrett, on, xxvii 89

Pulley Block, by Lieut. L. Shuldham, xxxiv 189

..... by Mr. Jas. Jones, xxxvi 103

Pump, for Well Sinkers, by Mr. W. Brunton, xxix 98

..... Double Piston, by Mr. P. Hedderwick, xxxii 98

..... Double Piston, Mr. R. W. Franklin, xxxiii 115

..... Forcing, by Mr. J. Stephens, xxxi 235

..... Lifting, by Mr. W. Aust, xxxvii 133

..... Ship's. See *Ship Building, &c.*

Pye, Mr. C., on a Method of preparing Charcoal to Draw with, xxxiv 129

Raft, Life. See *Shipwreck*

Rafter, Bow and String, by Mr. S. Smart, xxxvii 100

Raine, J. Esq., on Sea Elephant Oil from Van Dieman's Land, xl 238

..... on Wool from Van Dieman's Land, xl 238

Rake, a Cylindrical Traversing, by Mr. R. W. Barchard, xxxv 152

Ramshaw, Mr. James, on Heating Copper Plates by means of Steam, xxxvi 95

Rapson, Mr. J., on a Drag for Carriages, xxxiii 137

Rat-trap. See *Trap*

..... by Mr. S Bowler, xl 154

Razors. See *Cutting Instruments*

Reaping-hook, Mr. Jas. Hutton's, xxviii 54

Redman, Mr. D., Specimen of Lithography on English Stone, xxxvii 58

Reid, Mr. A., on a Compensation Pendulum, xxviii 230

Reticulated Square for Drawing, by Mr. T. Allason, xxxiv 145

Reveley, G., Esq., on the use of Soap instead of Oil in Setting Cutting Instruments, xxxix 137

..... H. W., Esq., on the nature and preparation of Mill-stones in Tuscany, xl 47

Rewards, Honorary. See *Medal*

Rewards, Pecuniary,

Thirty Guineas, to Mr. Lewis Aubery, for a Machine for Cutting Leather Straps, xxviii 192

Twenty Guineas, to Mr. W. Aust, for a Lifting Pump, xxxvii 133

Five Guineas, to Mr. J. Baker, for a Method of Purifying Whale Oil, xxxiii 65

Five Guineas, to Mr. W. Barlow, for an Improved Screw Wrench, xxvi 199

Five Guineas, to Mr. S. Bowler, for a Rat-trap, xl 154

Ten Guineas, to Mr. W. Bowler, for a Rat-trap, xxx 154

Five Guineas, to Mr. W. Bowler, for an Apparatus for Drying Grain, xxxiii 47

Five Guineas, to Mr. Jas. Braby, for a Cart and Drag, xxxii 45

Ten Guineas, to Mr. S. Brierly, for a Stretch for the Warp of Woollen Weavers, xxxvi 57

Twenty Guineas, to Mr. Richard Bridgen, for a Head-piece for Gilders, xxix 138

Fifteen Guineas, to Mr. J. Brockbank, for a Machine for making Slate-pencils, xxvii 175

Digitized by Google

Five Guineas, to Mr. W. Bullock, for a Service Pipe for Cisterns, xxxviii 57

Fifteen Guineas, to Mr. Jas. Callender, for a Method of Seasoning Mahogany, xxxv 71

Ten Guineas, to Mr. Richard Cathery, for a Method of preparing Ox-gall for the use of Painters, xxviii 106

Twenty Guineas, to Mr. R. D. Cathery, for a Method of Fixing Chalk Drawings, xxx 111

Five Guineas, to Mr. R. D. Cathery, for Transparent-paper, xxx 116

Ten Guineas, to Mr. F. Coad, for a Machine to enable Shoemakers to work standing, xxxv 160

Thirty Guineas, to Messrs. Cowley and Staines, for British Opium, xl 9

Fifty Guineas, to Mr. Jno. Davis, for a Fire Escape, xxviii 175

Fifty Guineas, to Mr. J. F. Denovan, for British-cured White Herrings, xxxvii 183

Fifty Pounds, to Mr. J. F. Denovan, for British-cured White Herrings, xxxviii 186

Ten Guineas, to Mr. C. Drury, for a strong Paste for Paper-hangers, &c., from Potatoes, xxxi 113

Thirty Guineas, to Mr. S. Einsle, for his Method of making Ivory Paper, xxxvii 59

Five Guineas, to Mr. T. Fisher, for a Swivel Headed Churn Staff, xxvi 131

Ten Guineas, to Mr. T. Hall, for a Self-acting Apparatus to supply Steam Engine Boilers with Water, xl 127

Ten Guineas, to Mr. Ar. Hodge, for a Pot for preserving Butter from Rancidity, xxx 87

Five Guineas, to Mr. J. Hughes, for an Improvement in the Silk Weaver's Draw-boy, xl 181

Ten Guineas, to Mr. Edwin Jones, for a Machine for serving Ships' Ropes, xxxiii 87

Five Guineas, to Mr. T. Keyworth, for Horn Tablets to Teach Children to Write, xxxii 167

Ten Guineas, to Mr. J. King, for a Machine for the use of Boot and Shoemakers, xxx 173

..... to Mr. Ed. Knight, for twenty-one Stocks of Bees, xxxi 79

..... to Mr. T. Lane, for an Instrument for gathering Fruit, xxxvii 20

Twenty Guineas, to Mr. Al. Law, for a Telegraph, xxxiii 118

Ten Guineas, to Mr. M. Levien, for a Harp-guitar, xxxii 117

Fifteen Guineas, to Mr. G. Marshall, for a Swing Window Sash, xxviii 209

Fifteen Guineas, to Mr. T. Marshall, for Blocks for Calico-printers, xl 178

Ten Guineas, to Mr. Jos. Martin, for a Method of relieving a fallen Horse from the Shafts, xxx 170

Five Guineas, to Mr. Moses Somerford, for a Door Lock, xxxvi 111

Ten Guineas, to Mr. D. Napier, for a Tracing Instrument, xxxvii 63

Twenty Guineas, to Mr. P. Nicholson, for a Centro-linead, xxxii 67

Ten Guineas, to Mr. Jas. Ogden, for a Pruning Instrument, xxx 89

..... to Mr. Jas. Ogden, for Improved Garden Shears and Pruning Instruments, xxxiii 40

Twenty Guineas, to Mr. Geo. Prior, for an Escapement for Pendulum Clocks, xxix 133

Twenty-five Guineas, to Mr. G. Prior, for a Guard for Dry Grinders, xxxi 206

Fifteen Guineas, to Mr. A. Reid, for a Compensation Pendulum, xxviii 230

Twenty Guineas, to Mr. E. Richards, for an Improved Draw-boy for Silk Weavers, xl 181

Ten Guineas, to Mr. B. Rider, for a Machine for cutting Tips for Hats, xxxix 70

Twenty Guineas, to Mr. Dav. Ritchie, for a Compensation Pendulum, xxx 176

Digitized by Google

Ten Guineas, to Mr. T. Roberts, for a Ventilator for Needle-pointers, xxxiv 233

Five Guineas, to Mr. E. Roberts, for a Churn, xxxvii 40

Ten Guineas, to Mr. Jno. Robertson, for a Machine for Weaving Tartan Hose, xxix 84

Fifteen Guineas, to Mr. J. D. Ross, for an Eye Bath, xxvii 203

Five Guineas, to Mr. J. D. Ross, for a Magnetic Hammer to Separate Iron from Brass Filings, xxviii 206

Five Guineas, to Mr. T. Saddington, for preserving Fruit without Sugar, xxvi 145

Thirty Guineas, to Mr. Thomas Saddington, for a Machine for covering Wire with Thread and Silk, &c., xxvii 117

Fifteen Guineas, to Mr. T. Saddington, for a Machine for covering Wire with Silk, &c., xxxv 117

Twenty Guineas, to Mr. W. Salisbury, for his Method of packing Living Plants for Exportation, xxvii 40

..... to Mr. R. Salmon, for Building Earthen Walls, xxvii 185

Ten Guineas, to Mr. T. Scorrar, for a Machine for Blocking Straw Hats, xxxiii 90

Fifteen Guineas, to Mr. Jno. Sholl, for an Improvement in the Silk Weavers Drawboy, xxviii 123

..... to Mr. B. Smith, for a Method of relieving a fallen Horse from the Shafts, xxviii 215

Fifty Guineas, to Mr. W. Smith, for a Six Sheet Mineralogical Map of England and Wales, xxxiii 51

Twenty Guineas, to Mr. T. Stiles, for British-cured White Herrings, xxxi 258

Five Guineas, to Mr. Jas. Stone, for an Expanding Center-bit, xxxi 250

..... to Mr. Jno. Tad, for a Method of preventing Doors from Dragging, xxvi 196

Five Guineas, to Mr. Peter Tansley, for a Cutter for making Silk Shag, xxvi 164

Fifteen Guineas, to Mr. T. Taylor, for a Repeating Alarum for Astronomical purposes, xxxvii 151

..... to Mr. J. Tilley, for a Blow-pipe for Enamellers, &c., xxxi 106

Ten Guineas, to Mr. H. Ward, for a Crank for Telegraphs, xxvi 207

Five Guineas, to Mr. James White, for a Double-door Spring, xxxviii 73

Twenty Guineas, to Mr. C. Williams, for a Machine for boring Brass Cocks, xxviii 196

Five Guineas, to Mr. Fred. Williams, for a Painters' Easel, xxxi 144

Twenty-five Guineas, to Mr. C. Wilson, for Artificial Stone, xxx 101

Ten Guineas, to Mr. C. Wilson, for a Method of preserving Oil Paintings, xxxi 142

Five Guineas, to Mr. C. Wilson, for his mode of Hanging Sash Windows, xxxii 176

Ten Guineas, to Mr. C. Wilson, for a Machine for Sweeping Chimnies, xxxv 184

Ten Guineas, to Mr. G. A. Witty, for a Fire Escape, xxxix 130

Twenty Guineas, to Mr. R. Wynn, for Receipts for Enamel Colours, xxxv 49

Twenty Guineas, to Mr. W. Wynn, for a Hammer for Turret Clocks, xl 105

Rhodes, Mr. G., on an Instrument to dry Woollen Warps on, xxxvii 75

Ribbon Weaver's Loom, by Mr. J. Thompson, xl 195

Rice, Mill for Decorticating, by Mr. H. Maudsley, xxxiv 252

..... Mountain; notice on several Varieties Cultivated in Napal, by Dr. Wallich, xxxix 155

Digitized by Google

Richards, Mr. E. on the Silk Weaver's Draw-boy, xl 181

Richardson, Mr. Robert, on a Machine for Drawing large Stones out of the Earth, xxvi 190

Ridge, the Rev. T., on a Method of Constructing Chimnies, so as to prevent the necessity of Sweeping them, xxxiii 131

Ridgway, Jos., Esq., on reclaiming Waste Land, xxxviii 15

Rider, Mr. B., on a Machine for cutting Tips for Hats, xxxix 70

Rigging. See *Ship Building*

Ritchie, Mr. D., on a Compensation Pendulum, xxx 176

..... on a Method of giving Motion to the Pendulum of a Clock, xxxvi 114

Roberts, Mr. Ed., on a Churn, xxxvii 40

..... Mr. Samuel, on a Machine for Sweeping Chimnies, xxvii 209

..... Mr. T., on a Fire Escape, xxxi 195

..... on a Ventilator for Needle-pointers, xxxiv 233

..... on an Improvement in Ship Building, xxvi 173

Robertson, Mr. J., on a Machine for Weaving Tartan Hose, xxix 84

Rodger, Mr. W., Lt. R. N., on a Plug for raising Empty Casks, xxxvi 100

..... on a Life Raft, xxxvii 112

Ropes, Ship's. See *Ship*

Ropes and Sacking made of Wool, by Mr. G. Whitworth, xxvi 153

Roofs. See *Architecture*

Rose, Mr. J., on a Glaze for Porcelain, xxxviii 42

Ross, Mr. J. D., on an Eye-bath, xxvii 203

..... on a Magnetic Hammer, xxviii 206

Rot, Dry, Prevention of, in Ship-timber, by A. Bowden, Esq., xxxvi 53

Rotch, Ben. Esq., on an Arcograph, xxxix 49—xl 259

Rowlock, a, by W. Brabazon, Esq., xxxvii 83

Roxburgh, Wm. M. D., on Caloe Hemp, xxvi 241

..... on Sundry Vegetable Products from India, xxvii 237

..... on the Preparation of East Indian Indigo, xxviii 251

..... Notice Concerning, xxxiii 156

Rudder. See *Ship Building, &c.*

Rule, Parallel. See *Painting and Drawing*

Russell, Mr. W., on a Lock for Liquor Cocks, xxxvii 94

Rutland, The Duchess of, on the best Method of raising Oaks for Timber, xxxiv 33

Ryan, Mr. G., on a System of Ventilation for Collieries, xxxiv 94

Saddington, Mr. John, on the Comparative Culture of Kohl-rabi Drum-headed Cabbage, and Swedish Turnips, xxvii 73

..... Mr. T., on Preserving Fruit without Sugar, xxvi 145

..... on a Machine for covering Wire with Thread and Silk, xxvii 117—xxxv 117

Safe Lamp. See *Collieries*

Sago, Grown at St. Vincent's, Dr. A. C. Anderson, on xxx 212

Sailcloth. See *Canvas*

Sails, Machine for cutting Canvas for, by Mr. W. Horn, xxxii 152

Salisbury, Mr. Wm., on his Method of Packing Living Plants for Exportation, xxvii 40

..... on Raising Grass Seed, and laying down land with the same, xxvii 67

Digitized by Google

Salisbury, Mr. Wm., on Cultivating Smyrna Madder, xxvii 104

..... on Matting, and other Articles made of the leaves of Typha Latipholia, xxxix 52

Salmon, Mr. Robert, on building earthen Walls, xxvii 185

..... on a Man-trap, xxvii 181

Salt, Fossil from India, xxvii 229.

.... Use of, in Anatomical Preparations, xxxvii 43

Sampson, Mr. W., on a Churn, xxx 95

Savage, Mr. G., on a Detached Escapement, xl 151

Scaffold. See *Architecture and Building*

Scarificator Improved. See *Surgical Instruments*

Scorrar, Mr. T., on a Machine for Blocking Straw Hats, xxxiii 90—xxxiv 163

Scotch Fir. See *Fir*

Scott, Mr. G. on a Clasp for Securing Standing Rigging when broken, xxxii 192

..... T. H. Esq., on Improving Waste Land, xxxii 34

Screens, Spring Clip for, by Mr. W. Bullock, xxxvii 92

Screws, Instrument for Cutting, by Mr. James Allan, xxxiv 207

Screw Wrench. See *Wrench*

Sculpture. See *Painting*

..... Instrument for Transferring Points in, by Mr. W. Behnes, xxxvii 172

Sea, Embanking from the. See *Embanking*

Sea Kale, on the Culture of, by Mr. Way, xxix 63

Shag, Silk, Cutter for making, by Mr. P. Tansley, xxvi 164

Shears, Garden, by Mr. James Ogden, xxxii 40

Sheep, Cure of Foot-rot in, by Mr. R. Parkinson, xxvi 126

Sheep, Merino, on Protecting, by J. G. Hall, Esq., xxxiv 78

Shepherd, Ed. Esq., on Wool from his Merino Flocks, xxx 130

Shetland, Discovery of Chromate of Iron in, xxxviii 23

Ship Building, Rigging, &c.

Prevention of Dry-rot, in Ship Timber, by A. Bowden, Esq. xxxvi 53

Timber, Method of Bending, by Mr. W. Hookey, xxxii 91

Securing the Beams by Iron Knees, by Mr. J. Roberts, xxvi 173

Ditto, by Mr. G. Williams, xxvii 142

Machine for examining the State of Ships Bottoms at Sea, by Mr. J. Buck, xxxiii 124

Lieut. M. Shuldham's Method of Ballasting Vessels, xxxvi 126

Temporary Rudder, by Captain J. Peat, xxxi 161

Temporary Rudder, by Captain T. M. Bagnold, xxxv 185

Bull's-eye and Ventilator, by Mr. G. Preston, xxxv 180

Improvement in Fitting-up Jury Masts, by Captain W. Bolton, R. N., xxvi 167

Clasp for Standing Rigging when Broken, by Mr. G. Scott, xxxii 192

Machine for Serving Ship's Ropes, by Mr. E. Jones, xxxiii 87

A Square Barrelled Ship's Pump, by Mr. Jac. Perkins, xxxviii 106

Rudders for Boats and Ships, by Mr. W. Hookey, xxxviii 125

..... Temporary, by Mr. W. Hookey, xxxviii 129

Boat's, Timbers and Knees, method of Making out of Straight Timber, by Mr. W. Hookey, xxxviii 131

Chain Beams for Merchant Ships, by Mr. W. Hookey, xxxviii 132

Apparatus for Propelling Ships of War, by Captain James Burton, R. N., xxxviii 136

Two Instruments for Ascertaining the Trim of Ships, by Mr. Jac. Perkins, xxxix 126

Digitized by Google

Copper for repairing Ships afloat, by Mr. W. Hookey, xl 122

Shipwreck, means of preserving Persons in case of, or in case of Falling overboard.

Captain Manby's Apparatus, xxvi 209

Major Le Hardy's, Do. xxxiv 182

Mr. H. Trengrouse's ditto, xxxviii 161

Rev. J. Bremner's Life Boat, xxviii 135

Mr. T. Boyce's, Do. xxxii 177

Mr. G. Bray's Life Boat, xxxv 172

Captain Gordon's Life-boat, xl 73

Mr. T. Cook's Life-raft, xxxvii 110

Mr. W. Rodger's Life-raft, xxxvii 112

Mr. T. Grant's Life Preserver, xxxvi 62

Mr. T. Cleghorn's Buoyant Line, xxxii 181

Mr. T. Cook's Night Life Buoy, xxxvi 121

Ship Timber. See *Ship Building*

Shoemakers. See *Boot and Shoemakers*

Sholl, Mr. John, on an Improvement in the Silk Weaver's Drawboy, xxviii 123

Shuldham, Mr. M., Lt. R. N., on a Pulley Block, xxxiv 189

..... on a Method of Working a Capstan, xxxiv 198

..... on a Method of Ballasting Vessels, xxxvi 126

Silkweaver's Loom, xl 181

Silver Medal. See *Medal*

Sinclair, the Right Hon. Sir J., on a French Portable Mill for Corn, xxxv 155

Skinner, Mr. J., on an Apparatus for Sweeping Chimnies, xxxviii 73

Skurray, C. T., Esq., on the Culture of Summer Wheat, xxx 73

Slate-pencils, Mr. Brockbank's Machine for Making, xxvii 175

State, (Writing) engraved, by Mr. Warren, xxvii 172

Smart, Mr. G., on a Bow and String Rafter, xxxvii 100

Smith, Mr. B., on a Method of relieving a Fallen Horse from the Shafts, xxviii 215

..... Mr. E., on Thread from the Common Nettle, xxviii 109

..... on Cloth from Nettle Fibres, xxix 81

..... Mr. J., on an Improved Umbrella Joint, xxxviii 72

..... Mr. W., on a Mineralogical Map of England and Wales, xxxiii 51

Smith and Founders, Blowing Machine for, xxxviii 87

Soda, Native of India, Dr. Heyne on, xxvii 238

Somerford, Mr. M., on a Door Lock, xxxvi 111

Sorghum, a Species of, Cultivated in Napal, xxxix 155

Spark, Mr. G. on a Noctuary, xxviii 234

Spencer, Mr. Knight, on an Anthropo-Telegraph, xxvii 153

Sphagnum, Palustre, Use of, in Packing Plants for Exportation, xxvii 40—xxx 198

..... Chemical Examination of, by Mr. A. T. Thompson, xxvii 47

Spirits, Hydrometer for, by Mr. H. Stokes, xxxviii 27

Spratt, Mr. J., on a Homograph, xxvii 163

Sprats, Essence of, by Mr. T. Stiles, xxxv 82

Spring-latch. See *Lock*

Stack, Capt. G. F., on an Apparatus for those who have lost an Arm, xxxviii 121

Digitized by Google

STO

Stall-feeding. See Cattle

Starkey, Mr. T., on Broad Cloth, Manufactured from New South Wales, Wool, xl 234

Steam-Boats, Method of propelling, by Mr. John Dickson, xxxiv 240

Steam-Engine Boilers, Self-acting Apparatus for supplying with Water, by Mr. T. Hall, xl 127

Steam-Trap, on a, by Mr. W. Farnham, xxxv 178

Steart, Mr. G., on Solid Paper Tablets for Drawing on, xxxix 43

Steel, Method of decarbonizing, xxxviii 52

..... Engraved, Method of hardening and Tempering, xxxviii 53

..... Engraving on. See Engraving

Stephens, J. Esq., on Making Bricks, xxix 39

..... Mr. J., on a Forcing-pump, xxxi 225

Stereotype Printing. Mr. Wilson, on, xxviii 317

Steuart, Patrick, Esq., on Planting Firs, Larch and other Timber Trees, xxxi 43

Slevin, Mr. P., on Curing White Herrings, xxix 161

Stiles, Mr. T., on British cured White Herrings, xxxi 258

..... on Essence of Sprats, xxxv 82

Stockdale, J. Esq., on Embanking from the Sea, xxviii 42

Stokes, Mr. H., on a Hydrometer for Spirits, xxxviii 27

Stone, Mr. James, on an Expanding Center-bit, xxxi 250

..... on a Double Door Spring, xxxii 173

Stone, Artificial, Mr. C. Wilson's, xxx 101

Stones, Method for Drawing large out of the Ground, by Mr. R. Richardson, xxvi 190

T

Story, Mr. James, on a Portable Oven, xxxix 73

Stove, for Burning Wood Shavings, by Mr. Jas. Davis, xxxi 155

Stove, for Ventilation, by Mr. Jac. Perkins, xxxix 133

Straw Plat, Mr. W. Corston, on the Manufacture of, xxviii 130

Straw-plat. See *Plat*

Stretch, a, for the Warp of Woollen-Weavers, by Mr. S. Brierly, xxxvi 57

Stucco, Mr. Way, on, xxix 73

Sun-dial, a, by Mr. G. Davies, xxxviii 147

Surgical Instruments,

Mr. T. Machell's Annular Saw, xxx 150

Various Surgical Instruments, by the Chevalier Assalini, xxxiii 93

Lancet for Opening Deep-seated Abscesses, by J. Hyslop, Esq., xxxiii 112

Apparatus for Extirpating Polypi, by Mr. W. Breinner, xxxiv 184

Craniotomy Forceps, by Dr. D. Davis, xxxv 188

Scarificator, by Mr. J. Fuller, xxix 126

Mechanical Substitute for Leeches, by Mr. J. Whitford, xxxi 229

A Bed for Surgical Patients, by Hen. Earle, Esq., xxix 148, xxxix 113

Ditto, by Mr. J. Woodall, xxxi 105

Bistoury, an improved, by Mr. J. Millikin, xl 69

Elastic Truss, by Mr. J. Whitford, xxviii 226

A Spring Bandage, by J. Gorman, Esq., xxxviii 76

Surveying-instruments. See *Astronomical*

Swaine, Mr. Jas., on a Cast Iron Finger-post, xxxi 240

T Square, Mr. E. Turrell, on a, xxxiv 139

Digitized by Google

Tablets, Glass, to Teach Children to Write, by Mr. M. Folsch, xxxii 162

Tablets, Horn, to Teach Children to Write, by Mr. T. Keyworth, xxxii 167

Tachometer, xxviii 185

Tad, Mr. Jno., on a Method of Preventing Doors from Dragging, xxvi 196

Tailors, Shop-board for, by Mr. Barrallet, xxx 147

Tallow, Mr. Bream's Boiler for, xxvii 198

Tanning, use of Larch Bark in, xxxi 81

Tansley, Mr. Peter, on his Cutter for making Silk Shag, xxvi 164

Taylor, Mr. Jno., on a Machine for renewing the Air in Mines, &c. xxviii 219

..... Mr. T., on a Repeating Alarum for Astronomical Purposes, xxxvii 151

Teak Tree, Dr. Roxburgh, on the Culture of the, xxx 203

Telegraph, Major Le Hardy's, xxvi 180

..... The Chevalier A. N. Edelcrantz's, xxvi 184

..... Mr. H. Ward's Crank for, xxvi 207

..... Mr. Knight Spencer's Anthropo-Telegraph, xxvii 153

..... Lieut. J. Spratt's Homograph, xxvii 163

..... Mr. A. Law's, xxxiii 118

..... and Dictionary, Admiral Sir H. Popham's, xxxiv 167

..... Night, the Rev. Jas. Bremner's, xxxiv 213

..... Day, the Rev. J. Bremner's, xxxiv 222

..... and Dictionary, Mr. Conolly's xxxv 205

..... Portable, Mr. Conolly's, xxxvi 98

..... Semaphore and Shifting Key, by N. H. Nicolas, Esq., xxxix 104

Temporary Rudder. See *Ship Building, &c.*

Thackeray, W. M. M.D., on Plantations of Forest Trees, xxvii 25

..... on Planting Forest Trees, xxxvii 1

Thanks of the Society, to

Mr. R. Ackermann, for a Portable Lithographic Press, xxxvii 131

Jas. Amos, Esq., for a Sample of East Indian Caoutchouc, xxx 191

Alexander Anderson, M. D., on the Economical Use of certain Plants, Natives of the West Indies, xxvi 234

..... for a Paper on the Cultivation of Black Pepper at St. Vincent's, xxvii 228

..... for a Paper on the Cultivation of Nutmegs, in St. Vincent's, xxviii 313

..... for Sago, grown at St. Vincent's, xxx 212

Capt. T. M. Bagnold, for a Temporary Rudder, xxxv 185

Mr. Bream, for a Boiler for Tallow Chandlers, xxvii 198

Mr. M. Cawood, for a Mode of Connecting Water Pipes, xxxiv 244

Mr. S. Clegg, for his Coal Gas Apparatus, xxvi 202

Major Spenser Cochrane, for a Communication on Feeding Horses with Furze, xxvii 77

The Cork Institution, for Specimens of Marble, from the County of Cork, xxx 109

J. C. Curwen, Esq., for additional Information on Stall Feeding Cattle, xxxii 56

The Dublin Society and its Vice President, Lieut. Gen. C. Vallancy, for Specimens of Irish Marble, xxviii 68

Mr. Rd. Green, for Instruments wherewith to scoop out the Eyes of Potatoes, xxxi 74

T. Hoblyn, Esq., for introducing into Ceylon, Messrs. Bramah's Hydro-mechanical Press, for the Extraction of Cocoa-nut Oil, xxxiv 261

Digitized by Google

Mr. T. Hood, for Samples of Canvass for the Use of the Navy, xxxiv 165

Mr. Jas. Horne, for a Door Fastening, xxxiv 243

J. Lawrence, Esq., for Improved Crutches for the Lame, xxxii 109

Mr. J. Maclachlan, for Specimens of Fossil Salt from India, xxvii 229

J. Miller, Esq., for an Instrument for saving Persons from Drowning when the Ice breaks, xxxii 194

Alexander Mitchell, Esq., for Specimens of Scotch Granite, &c., xxviii 71

Admiral Sir H. Popham, for an Improved Method of Cutting Flags, xxxiv 173

The Rev. T. Ridge, for a Method of constructing Chimnies, so as to prevent the Necessity of Sweeping them, xxxiii 131

Mr. Sam. Roberts, for a Machine for Sweeping Chimnies, xxvii 209

Wm. Roxburgh, M. D., for his Communication of Caloe-hemp, &c., xxvi 241

,..... for sundry Vegetable Products from India, xxvii 233

..... on the Management of Growing Plants at Sea, xxvii 237

..... on the Cultivation and Management of the Teak-tree, xxx 203

Mr. T. Saddington, for Comparative Experiments on the Culture of Kohl-rabi, Drum-headed Cabbage, and Swedish Turnips, xxvii 73

Mr. Wm. Salisbury, for Cultivating Smyrna Madder, xxvii 104

The Rt. Hon. Sir J. Sinclair, bart., for his Present of a French Portable Mill for Flour, xxxv 155

Mr. C. Varley, for a Portable Easel for Painters, xxxiii 82

H. B. Way, Esq., for a Communication on the Culture of Hemp, and of Sea Kale, xxix 63

,..... for a Paper on Bread made of Wheat Flour, and Potatoes, xxx 105

J. C. Curwen, Esq. M. P., for an Experiment on Draining Land, xxxix 36

Perkins, Mr. Jac., for his Stove for Ventilation, xxxix 133

Messrs. Perkins, Fairman, and Heath, for their Process of Engraving on Steel, as applied to the Prevention of Forgery, xxxviii 47

Pritchard, Mr. W., on Buffaloe's Wool, as a Material for Hats, xl 228

Reveley, Geo. Esq., for a Communication on the use of Soap instead of Oil, in setting cutting Instruments, xxxix 137

Theodolite, by Mr. Jas. Allan, xxxiv 206

Thermometer, Marine, Case for a, by Mr. R. Jamieson, xxxviii 32

..... Use of, in Navigation, xxxviii 36

Thistles and Docks. See *Docks*

Thom, Mr. R. on a Hydraulic Self-acting Apparatus, for Regulating the Supply of Water to Mills, xl 78

Thompson, Mr. J., on a Loom for Ribbon-weavers, xl 195

Thornhill, B. Esq., on Planting Forest-trees, xxxiii 33

..... on Planting Forest Trees, xxxiv 74

Thrashing Machine, Mr. Lee's, xxviii 25

Tilley, Mr. J., on a Blowpipe for Enamellers, &c., xxxi 106

Timber, Ship. See *Ship Building*

Time-keeper. See *Clock*

Tomkins, Mr. P. W., Method of rendering Ox-gall Colourless, xxxi 130

Towers, R. Esq., on Embanking from the Sea, xxviii 42

Tracing Instruments. See *Painting and Drawing*

Transparent Paper. See *Paper*

Trap for Rats, Mr. W. Bowler's, xxx 154

Ditto, Mr. S. Bowler's, xl 154

Digitized by Google

Traversing Apparatus, by the Rev. Dr. Cartwright, xxxiv 177

Trees, Forest, Tables by Mr. Chas. Waistell, showing the progressive Growth and Value of, &c., xxvi 45, xxvii 79

..... growth of certain Species in the Botanic Garden at St. Vincent, xxvi 240

..... Table, showing the progressive Growth of young trees for ten Years, by J. H. Moggridge, Esq., xxx 49

Trengrouse, Mr. H., on an Apparatus to preserve Persons in case of Shipwreck, xxxviii 161

Trim of Ships. See *Ship Building, &c.*

Truss for Ruptures, Mr. J. Whitford's Elastic, xxviii 236

Turners, Chuck for, by Mr. A. Bell, xxxvii 85

Turnip Sower, Double Drill, by Mr. J. Common, xxxvi 24

Turnips, Preservation of, through the Winter, by Messrs. Cowley and Staines, xl 29

Turpentine from the Scotch Fir, xxviii 86

Turrell, Mr. E., on an Instrument for Drawing in Perspective, xxxii 76

..... Mr. E., on a Drawing-board and T square, xxxiv 139

Typha Latifolia, the Leaves of, made into Matting, &c., by Mr. W. Salisbury, xxxix 52

Urtica, Tenacissima. See *Caloe Hemp*

Umbrella, an Improved Joint for, by Mr. J. Smith, xxxviii 72

Van Dieman's Land, Wool from, xl 236

..... Sea Elephant Oil, from, xl 238

Vapour Bath. See *Bath*

Varley, Mr. C., on a portable Easel for Painters, xxxiii 82

Varnish and Naphtha, from Coal-tar, xxviii 73

Varty, Mr. J., on an Improved Axle-tree, xxvii 145

Velocity of Machinery, Mr. Donkin's Instrument for ascertaining, xxviii 185

Ventilating and Warming, Mr. Jac. Perkins' Method of, xxxviii 80

Violoncello, by Mr. J. Barraud. See *Musical Instruments*

Waistell, Mr. Chas., on the progressive value of growing Timber Trees, with Tables for thinning Plantations of, &c., xxvi 45—xxvii 79

..... on an Improved Dibble for Acorns, xxix 60

Wales, New South, fine Wool from. See *Wool*

Wallich, Dr., on several varieties of Mountain Rice, on a species of Sorghum (*Andropagon cernuum*), on Caloe Hemp, xxxix 155

Walls, Earthen, Mr. R. Salmon's Method of Building, xxvii 185

Warcup, Mr. W., on a Curvagraph, xxxv 109

Ward, Mr. H. correction of the description of his Compensation Pendulum, in Vol. xxv, xxvi 208

..... for a Crank for Telegraphs, xxvi 207

..... on an Equation Work for a Clock, xxxii 144

Warren, Mrs. M. A., on a Piano-monitor, xxxv 85

..... Mr. Thos. on an Engraved Slate, xxvii 172

Waste Land, Improvement of,

400 Acres, in the Parish of Workington, Cumberland, by J. C. Curwen, Esq., M.P., xxxiii 25

50 Acres at Pittington, Durham, by the Rev. Dr. Fr. Haggitt, xxx 37

294 Acres of Peat Moss, at Worsley, Lancashire, by R. H. Bradshaw, Esq., M.P., xxxvi 1

220 Acres, in the Parish of South Stoneham, Southamptonshire, by T. H. Scott, Esq., xxxii 36

Digitized by Google

308 Acres, near Crawley, Sussex, by W. C. Knowlys, Esq., xxxi 33

180 Acres, in the Parish of Arncliff, Yorkshire, by Godfrey Higgins, Esq., xxxii 27

21 Acres, at Clapham, Yorkshire, by Major Br. Heselden, xxx 40

177 Acres, at Horton, Yorkshire, by Major Br. Heselden, xxxi 25

65 Acres, in the Parish of Bramshot, Hampshire, by J. Butler, Esq., xxvi 117

84 Acres, in the Parish of Dean, Lancashire, by Jos. Ridgway, Esq., xxxviii 15

56 Acres, in the Parishes of Linton and Ingleton, Yorkshire, by J. Peart, Esq., xl 1

Watch. See *Clock*

Water-pipes, a Mode of Connecting, by Mr. M. Cawood, xxxiv 244

Water-wheels, Improved Axle for, by Mr. R. Hughes, xxxi 221

..... Method of Drawing off the Back Water from, by Mr. Jac. Perkins, xxxviii 109

Watson, Mr. J., on a System of Musical Notation for the use of the Blind, xl 78

Way, Mr. H. B., on Turpentine from the Scotch Fir, xxviii 86

..... on the culture of Hemp and of Sea-kale, xxix 63

..... on Stucco, xxix 73

..... on Bread made of Wheat Flour and Potatoes, xxx 105

..... on preserving Carrots through the Winter, xxxiii 45

Weaving,

Mr. Sholl's Improvement on the Silk Weaver's Draw-boy, xxviii 123

Mr. Richards's, ditto, xl 181

Mr. Hughes's, ditto, ditto

Mr. Thompson's Ribbon Loom, xl 195

Mr. J. Robertson's Machine for Tartan Hose, xxix 84

Woollen Warp, Mr. Brierly's Stretch for, xxxvi 57

..... Mr. Rhodes's, xxxvii 75

Webster, Mr. Geo., on a Method of getting rid of the Steam from Boilers, xxix 145

Weighing Machine, by Mr. W. Martin, xxxii 157

..... by Mr. J. Braby, xxxiii 150

West, Mr. C., on a Parallel Rule, xxxiv 137

Whale Oil. See *Oil*

Whatley, J., Esq., on a Machine for Grinding Potatoes, xxxi 46

Wheat, experiments on the culture of, by Robert Burrows, Esq., xxvi 93

..... Summer, culture of, by C. T. Skurray, Esq., xxx 73

..... sown after Beans, without an intermediate Fallow, xxxi 76

Wheel Carriages, prevention of accidents with,

Mr. J. Varty's Axle-tree, xxvii 145

Mr. J. Padbury's Axle-guard, xxxi 225

Mr. R. Phillips's Axle, xxxvii 158

Mr. Rapson's Drag, xxxiii 137

Wheels, Water. See *Water-wheels*

Wheel Carriages, Improved Blocks and Springs for, by Mr. T. C. Cherry, xxxviii 93

..... Safe Coach, by Mr. O. Elliott, xxxviii 143

White, Mr. Jas., on a Double Door Spring, xxxvii 102

..... Mr. Richard, on a File for Receipts, xxvii 170

..... T. Esq., on Tanning Leather by Larch Bark, xxxi 81

..... Mr. Jas., on a Double Door Spring, xxxviii 70

Whitford, Mr. J., on a Mechanical substitute for Leeches, xxxi 229

..... on an Elastic Truss for Ruptures, xxviii 236

Digitized by Google

Whitlow, Mr. C., on a Method of Preserving Potatoes at Sea, xxxiii 196

Whitworth, G. Esq., on Manufacturing Ropes and Sacking of Wool, xxvi 153

Wigzell, Mr. E., on an Instrument for Marking a Ship's Place on a Chart, xl 158

Wilkinson, Mr. Jas., on a Turnwrest Plough, xxxii 38

Williams, Mr. C., on a Machine for boring Brass Cocks, xxviii 196

..... on a Family Corn Mill, xxxii 102

..... Mr. Fred., his Painters' Easel, xxxi 144

..... Mr. G., on an Improved Method of securing the Beams of Ships, xxvii 142

..... Mr. R., on a Method of removing the Centering of Arches, xxxiii 127

Wilson, Mr. A., on Stereotype Printing, xxviii 317

..... Mr. C., on Artificial Stone, xxx 101

..... his Method of Preserving Oil Paintings, xxxi 142

..... on a Mode of Hanging Sash Windows, xxxii 176

..... on a Machine for Sweeping Chimnies, xxxv 184

Windows, cleaning, Prevention of Accidents in, xxviii 209

Window-sash, swinging, xxviii 209

..... Mode of Hanging, by Mr. C. Wilson, xxxii 176

Windows, large, a Mode of Opening and Shutting, by Mr. W. Bailey, xl 173

Winnowing Machine. See *Corn*

Wire for Cards. See *Cards*

..... Machine for Covering with Silk, &c., by Mr. T. Saddington, xxvii 117, xxxv 117

Witty, Mr. G. A., on a Fire-escape, xxxix 130

Wood, Mr. Geo., on a Parallel Rule, xxxv 113

..... Mr. Thos., on a Grindstone for Needle Pointers, xxix 143

Woodall, Mr. J., on a Bedstead for the Sick and Infirm, xxxii 105

Woodhouse, Miss S., on a New Material for Straw Plat, xl. 217

Wool, Merino, grown in England, by T. Buck, Esq., xxxiv 155

..... Merino, raised in England, by E. Sheppard, Esq., xxx 130

..... Ropes and Sacking, made of, by Mr. G. Whitworth, xxvi 153

..... Fine, from New South Wales, by J. M'Arthur, Esq., xl 230

Woollen Warps, an Instrument on which to dry them, by Mr. G. Rhodes, xxxvii 75

Wrench for Screws, Mr. Wm. Barlow's, xxvi 199

Writing, Mr. T. Perry's Instrument for forming the Hand in, xxx 156

Wynn, Mr. R., his Receipts for Enamel Colours, xxxv 49

..... Mr. W., on a Hammer for Turret Clocks, xl 105

..... on a Time-keeper, and Compensation Pendulum, xxxv 127

Wynne, Sir W. W. Bart. M. P., on Planting Forest Trees, xxxvi 18

Young, J. Esq., on the Preparation of Opium in Great Britain, xxxvii 23, xxxviii 21

..... Mr. A. Jun., on a Fire-Escape, xxxi 244

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